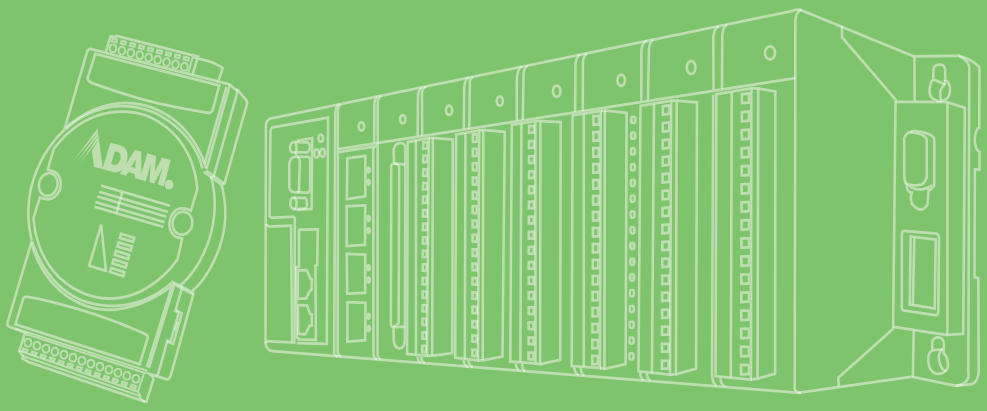

User Manual

ADAM-5560 Series

Programmable Automation Controllers

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Part No. XXXXXXXXXX Edition 1

Printed in Taiwan February 2014

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (OS, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
15. The power cord or plug is damaged.
16. Liquid has penetrated into the equipment.
17. The equipment has been exposed to moisture.
18. The equipment does not work well, or you cannot get it to work according to the user's manual.
19. The equipment has been dropped and damaged.
20. The equipment has obvious signs of breakage.
21. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
22. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Contents

Chapter 1

Overview

1.1 Introduction

ADAM-5560 Series Controller is Programmable Automation Controller designed for control tasks which require Industrial PC computing performance with the PLC's robustness. ADAM-5560 Series Controller offers Intel ATOM Z510P CPU along with control specific features such as watchdog timer, battery backup RAM and deterministic I/O.

ADAM-5560KW Controller features 5 standard IEC61131-3 programming languages in CE 5.0, so PLC users can develop control strategies with their own familiar programming languages. The powerful Multiprog KW Software and stable ProCon OS have allowed ADAM-5560KW Controller to become the best choice for a Programmable Automation Controller on the market today. With the optional HMI Software and built-in VGA port. User will no longer be required to build up additional SCADA PC's in their applications. This compact and powerful PAC is ideal for a variety of applications ranging from Machine Automation to SCADA applications.

The ADAM-5560 Series Controller includes two models as following:

ADAM-5560CE 7-slot PC-based Programmable Controller

ADAM-5560KW 7-slot Programmable Automation Controller

1.2 Features

The hardware system of ADAM-5560 Series Controller consists of two major components: the main unit and I/O modules. The main unit includes a CPU card, a power module, an 7-slot backplane and four serial communication ports. ADAM-5560 Series Controller also embeds two Ethernet ports, two USB ports and VGA port. The .NET class Library is needs for developing the program for ADAM-5560CE. The Multiprog software is also needed for developing the control program for ADAM-5560 Series Controller. Following are the major features:

- Designed for control tasks that meet robust and computing performance requirements of PLC and Industrial PC's
- Built-in VGA Port
- Support Storage Function by Battery Backup RAM and SD Card I/O Module
- Built-in real-time clock and watchdog timer
- Support .NET class library (For ADAM-5560CE)
- SoftLogic support in CE 5.0
- Process IEC-61131-3 standard with rich development environment (For ADAM-5560KW)
- Cross-Language programming (For ADAM-5560KW)
- Deterministic I/O
- Real time multi-task engine
- Custom Function Block (For ADAM-5560KW)
- Pre-defined function library (For ADAM-5560KW)
- Powerful debug / diagnostic / simulation / force tools
- Online editing & partial download
- Rich support to ADAM-5560 I/O Modules
- Dual Ethernet Ports
- Remote maintenance via FTP Server
- Built-in SQL Mobile Server
- RS-232/485 communication ability
- Remote I/O expansibility

Designed for control tasks that meet robust and computing performance requirements of PLC and Industrial PC's

ADAM-5560 Series Controller is designed for control tasks which need Industrial PC's computing performance and PLC's robustness. Its multiple functionalities include discrete, analog and motion functions. The well-integrated programming tool and optional HMI software provide a flexible and easy-to-use software solution for versatile applications.

Built-in VGA port

ADAM-5560 Series Controller has a built-in VGA port which can directly connect to a display. So HMI function can be integrated into this controller. ADAM-5560 Series Controller can be operated with or without display and/or keyboard/mouse which can meet different requirements of applications.

Support atorage function by battery backup rAM and SD card I/O module

ADAM-5560 Series Controller has built-in 1GB DDR2 SDRAM with 1MB battery backup RAM for saving important data. The ADAM-5030 I/O Module supports two SD cards and two USB ports. So users can use SD cards or USB sticks for large amount of data storage requirement.

Built-in real-time clock and watchdog timer

The ADAM-5560 Series Controller also includes a real-time clock and watchdog timer. The real-time clock records events while they occur. The watchdog timer is designed to automatically reset the microprocessor if the system fails. ADAM-5560 Series Controller provides two types of watchdog timers. They are Operating System Watchdog and KW application watchdog. It will increase the reliability of system and make the ADAM-5560 Series Controller ideal for use in applications which require high system stability.

SoftLogic Support in Windows CE 5.0

ADAM-5560KW Controller supports IEC-61131-3 programming in WinCE 5.0. The five programming languages of Ladder Diagram, Function Block, Sequential Function Chart, Structured Text and Instruction List cover most of the PLC programming languages in the market. The reliable PROCONOS runtime engine and powerful MULTIPROG software from KW-Software empower ADAM-5560KW Controller as the best solution of Programmable Automation Controller.

Process IEC 61131-3 standard with rich development environment

The standard IEC 61131-3 has been established to standardize the multiple languages, sets of instructions and different concepts existing in the field of automation systems. The great variety of control concepts has led to an incompatibility between the different control platforms and manufacturers. The result was a great effort to be made for training, hardware and software investments.

IEC 61131-3 defines the syntax of 5 programming languages, defines a certain representation and describes the different elements which can be used in the language.

The programming languages can be differentiated by the physical appearance into 2 textual languages and 3 graphical languages.

Table 1.1: Programming Languages Table	
Textual Languages	**Graphical Languages**
Instruction List (IL) Structured Text (ST)	Function Block Diagram (FBD) Ladder Diagram (LD) Sequential Function Chart (SFC)

Cross-Language Programming

For some project integrate and scalable issues, cross-language can help you to choose the different language for your project. For example, you can use ladder (LD) on the simple I/O module control or simple logical expression and use Function Block (FB) on process control for more advanced expression and use Sequential Function Chart (SFC) for system configuration in hybrid control system such as Water Treatment.

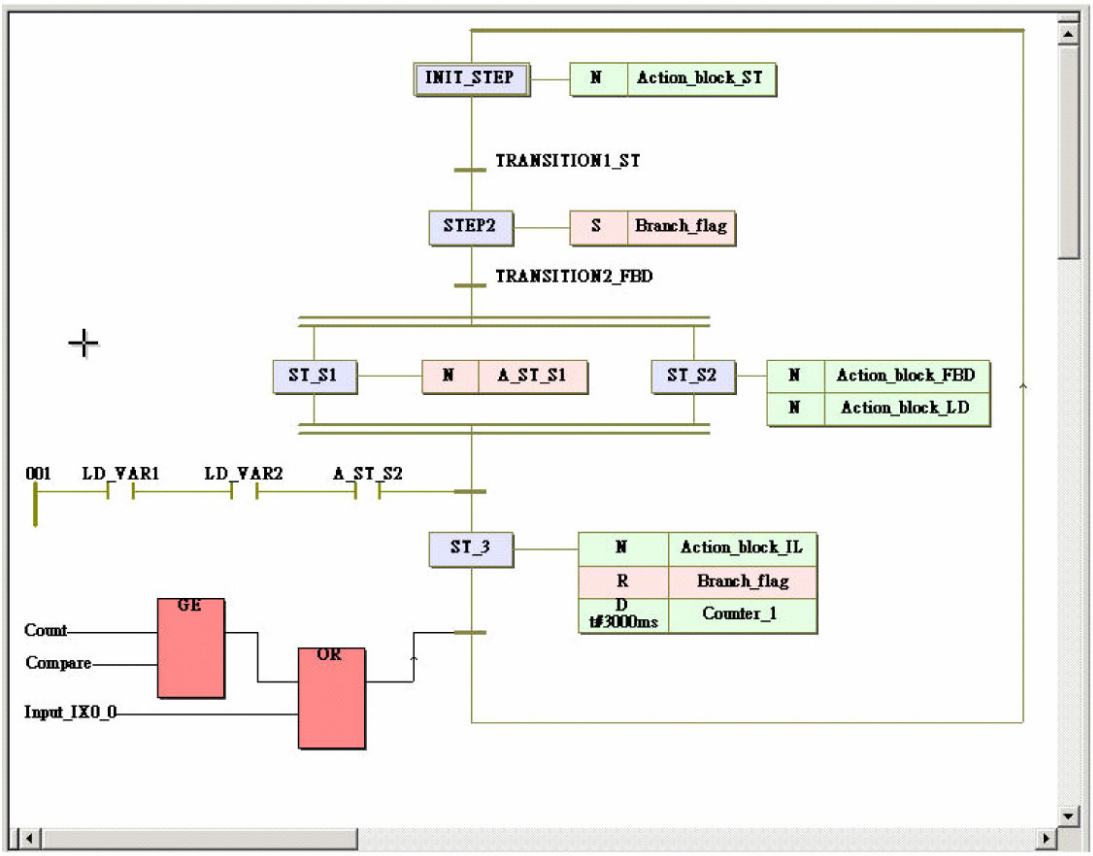


Figure 1.1 Cross-Language Programming

Deterministic I/O

ADAM-5560 Series Controller can guarantee deterministic I/O at 1ms. The feature guarantees control and response speed at I/O level so HMI software or operations of other application programs cannot affect the I/O control performance.

Real time multi-task engine

ADAM-5560 Series Controller provides the multi-task and multi-program environment. ADAM-5560 Series Controller's communication, data process and I/O access tasks are working independent, so the system performance and efficiency are better than traditional PLC.

Custom Function Block for complex control

ADAM-5560KW Controller allows custom function block for advanced control algorithm such as fuzzy logic control or neural network control function. Users can define their own function block for common use function or special domain know-how. The control kernel also provides powerful floating point calculation and rich memory for complex control.

Pre-defined function library

Advantech Multiprog provides many pre-defined function library such as maximum of strings as string function block, Convert REAL to INT as type convert function block. It helps you to build up your program more conveniently. It is more convenient than the traditional control programming tools. With this pre-defined function, you can make your project easier in timer control, variable type conversion or strings conversion, etc.

Powerful debug / diagnostic / simulation / force tools

Advantech Multiprog provides lots of powerful tools for debug, diagnostic, simulation and force function. It shows friendly interfaces when you use these tools. With debug / diagnostic tools, you can make it easier on trouble-shooting. Advantech Multiprog simulator supports program verification offline directly on your PC. This is great in case you are developing logic and you do not have access to a controller. To activate an I/O simply click on the LED you want to energize and your logic executes as if it was a real I/O. The program operation is the same as if you actually were connected to the controller, so all the debug tools are fully functional: power and logic flow, I/O force and overwriting. With force tools, you can check more exception situations and check if the project handling right or wrong. It prevents the damage for you.

Online editing & partial download

Online editing is a MUST even though many packages do not support it. It is unacceptable to shut down the machine or process to perform maintenance, not to mention how difficult it is to debug when you have to switch back and forth from program to run mode. Multiprog supports online editing so you can make changes and then download the changes to the controller WITHOUT stopping the machine or process. It helps you to maintain your system easier and save the cost for your system process.

Rich support to ADAM-5560 I/O Modules

Most of the ADAM-5560 I/O modules are supported by ADAM-5560 Series Controller including analog I/O modules, digital I/O modules and motion control module. All the operations of supported modules are the same with the operations of ADAM-5510 series.

The ADAM-5560 Series Controller uses a convenient backplane system for supporting versatile I/O modules. Advantech's complete line of ADAM-5560 I/O modules integrates with the ADAM-5560 Series Controller to support your applications. Following table is the latest I/O module support list we provided for user's choice.

Table 1.2: I/O Module Support List

Function	Module	Description	Reference
Analog Input	ADAM-5013	3-ch RTD Input	Isolated
	ADAM-5017	8-ch AI	Isolated
	ADAM-5017P	8-ch AI w/Independent Input Range	Isolated
	ADAM-5017H	8-ch High Speed AI (1KHz)	Isolated
	ADAM-5017UH	8-ch Ultra High Speed AI (200KHz)	Isolated
	ADAM-5018	7-ch TC Input	Isolated
	ADAM-5018P	7-ch TC Input w/Independent Input Range	Isolated
Analog Output	ADAM-5024	4-ch AO	Isolated
Digital Input	ADAM-5051	16-ch DI	Non-isolated
	ADAM-5051D	16-ch DI w/LED	Non-isolated
	ADAM-5051S	16-ch Isolated DI w/LED	Isolated
	ADAM-5052	8-ch Isolated DI w/LED	Isolated
	ADAM-5053S	32-ch Isolated DI	Isolated
Digital Output	ADAM-5056	16-ch DO	Non-isolated
	ADAM-5056D	16-ch DO w/LED	Non-isolated
	ADAM-5056S	16-ch Isolated DO w/LED	Isolated
	ADAM-5056SO	16-ch Source Type Isolated DO w/LED	Isolated
	ADAM-5057S	32-ch Isolated DO	Isolated
Digital I/O	ADAM-5050	16-ch DI/O	Non-isolated
	ADAM-5055S	16-ch Isolated DI/O w/LED	Isolated
Relay Output	ADAM-5060	6-ch Relay Output	Isolated
	ADAM-5069	8-ch Power Relay Output w/LED	Isolated
Counter/ Frequency	ADAM-5081	4-ch/8-ch High Speed Counter/Frequency	Isolated
Communication	ADAM-5091	4-port RS-232 Module	Non-isolated
	ADAM-5095	2-port CAN Module	Isolated
Storage	ADAM-5030	2-slot SD Storage Module	Non-isolated
Motion	ADMA-5202	2-port AMONet Master Module	Isolated
	ADAM-5240	4-axis Stepping/Servo Motor Control Module	Isolated

Note! *For details, refer to ADAM-5000 I/O Module User's Manual.*

Dual Ethernet Ports

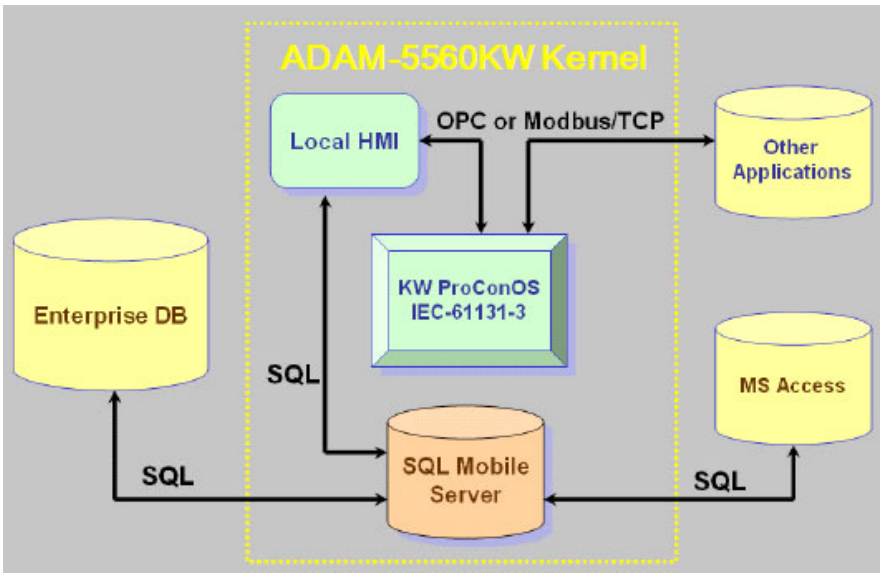
ADAM-5560 Series Controller provides two Ethernet ports for different application requirements such as redundant Ethernet connection for reliability concern or separated network connections for security concern. Both of the functions are possible to be implemented by customer's application program.

Remote maintenance via FTP Server and DiagAnywhere Software

For remote maintenance function, the built-in FTP server provides service for uploading application program or downloading data logging files. DiagAnywhere Software is also supported for remote control, download and upload functions.

Built-in SQL Mobile Server

ADAM-5560KW Controller embeds SQL server so it is very easy to exchange data between enterprise database/local HMI software and SQL server by SQL query functions. Following is the Architecture of ADAM-5560KW Controller Kernel.



RS-232/485 communication ability

The ADAM-5560 Series Controller has four serial communication ports, giving it excellent communication abilities. This facilitates its ability to control networked devices. ADAM-5560 Series Controller COM1/COM3/COM4 are RS-232/485 selectable port and COM2 is a dedicated RS-485 por. These four ports allow the ADAM-5560 Series Controller to satisfy diverse communication and integration demands. With this communication ports, you should not buy more I/O communication device and save more costs. You can also extend your system by using these communication ports. Please refer to following figure and check the location of COM ports.

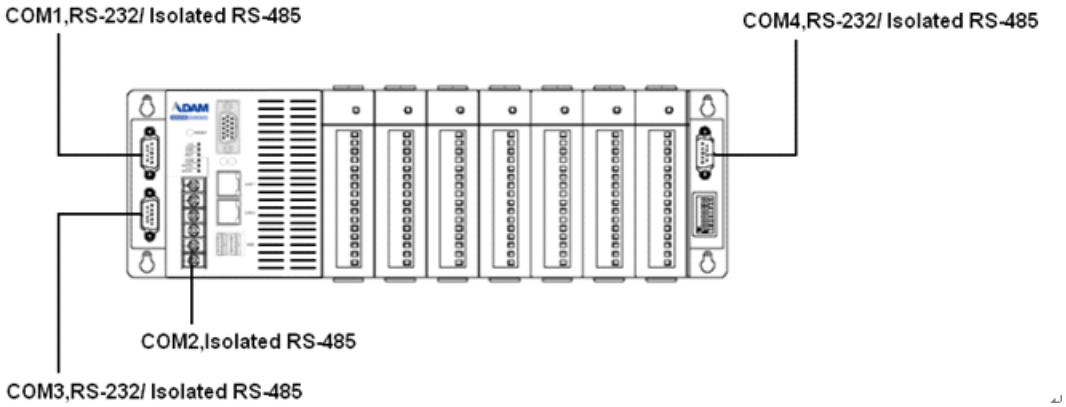


Figure 1.2 ADAM-5560 Communication Ports

Remote I/O Expansibility

ADAM-5560 Series Controller supports not only Modbus/RTU Master function via serial ports, but also the Modbus/TCP Client to retrieve data from remote I/O, and Modbus/TCP Server to exchange data with other Modbus devices via Ethernet port. This Modbus features are very useful when the control system needs expand the remote I/O modules or connect to other controllers.

1.3 Specifications

1.3.1 System

- CPU: Intel ATOM Z510P Processor
- Operating system: Windows CE 5.0
- Memory: 1 GB DDR2 SDRAM with 1MB Battery Backup
  One CompactFlash® Card (Internal)
- Real-time clock: Yes
- Watchdog timer: Yes
  - Operating System Watchdog
  - KW application watchdog
  - Modbus server communication watchdog
- USB Port: USB 2.0 ports * 2
- VGA Port: 1024 X 768 Resolution
- Ethernet Port: 10M/100M bps * 2
  RJ-45 connectors
- COM1: RS-232/485 selectable, DB-9 connector
- COM2: RS-485, Terminal Block
- COM3: RS-232/485 selectable, DB-9 connector
- COM4: RS-232/485 selectable, DB-9 connector
- I/O capacity: 7 slots
- Maximum number of nodes: 256 nodes
- System power consumption: 17 W (without I/O modules)

1.3.2 USB Ports

- USB 2.0

1.3.3 VGA Port

- 1024 X 768 Resolution

1.3.4 Ethernet Ports

- 10M/100M bps x 2
- RJ-45 connectors
- Transmission Speed 10M/100M bps (10/100 Base-T)

1.3.5 RS-232/485 interface (COM1)

- RS-232/485 Mode selectable by jumper
- RS-232 Mode: Asynchronous full duplex, point to point
  Signals: TxD, RxD, RTS, CTS, DTR, DSR, DCD, RI, GND
- RS-485 Mode: Half duplex, multi-drop
  Signal: DATA+, DATA-

- Connector: DB-9 pin
- Transmission speed: Up to 115.2 Kbps
- Max transmission distance:
  - RS-232: 50 feet (15.2 m)
  - RS-485: 4,000 feet (1220 m)

1.3.6 RS-485 interface (COM2)

- Signals: DATA+, DATA-
- Mode : Half duplex, multi-drop
- Connector: Screw terminal
- Transmission speed: Up to 115.2K bps
- Max transmission distance: 4000 feet (1220 m)

1.3.7 ES-232/485 interface (COM3) (Suitable for touchscreen)

- RS-232/485 Mode selectable by jumper
  RS-485 Signal: DATA+, DATA-
- RS-232 Mode: Asynchronous full duplex, point to point
  Signals: TxD, RxD, RTS, CTS, DTR, DSR, DCD, RI, GND
- RS-485 Mode: Half duplex, multi-drop
  RS-485 Signal: DATA+, DATA-
- Connector: DB-9
- Transmission speed: Up to 115.2K bps
- Max transmission distance:
  - RS-232: 50 feet (15.2 m)
  - RS-485: 4000 feet (1220 m)

1.3.8 RS-232/485 interface (COM4)

- RS-232/485 Mode selectable by jumper
  RS-485 Signal: DATA+, DATA-
- RS-232 Mode: Asynchronous full duplex, point to point
  Signals: TxD, RxD, RTS, CTS, DTR, DSR, DCD, RI, GND
- RS-485 Mode: Half duplex, multi-drop
  RS-485 Signal: DATA+, DATA-
- Connector: DB-9
- Transmission speed: Up to 115.2K bps
- Max transmission distance:
  - RS-232: 50 feet (15.2 m)
  - RS-485: 4000 feet (1220 m)

1.3.9 Isolation

- COM2: 2500 Vrms
- COM1/COM3/COM4: 1000 Vrms (RS-485 only)

1.3.10 Power

- Unregulated +10 to +30 VDC
- Protected against power reversal
- Power consumption: 17 W (not including I/O modules)

1.3.11 Mechanical

- Case: ABS+PC with captive mounting hardware
- Plug-in screw terminal block:

  Accepts 0.5 mm^2 to 2.5 mm^2, 1 - #12 or 2 - #14 to #22 AWG

1.3.12 Environment

- Operating temperature: 0 ~ 55° C (32 ~ 122° F)
- Storage temperature: -25° to 85° C (-13° to 185° F)
- Humidity: 5 to 95 %, non-condensing
- Atmosphere: No corrosive gases

Note! *Equipment will operate below 30% humidity. However, static electricity problems occur much more frequently at lower humidity levels. Make sure you take adequate precautions when you touch the equipment. Consider using ground straps, anti-static floor coverings, etc. if you use the equipment in low humidity environments.*

1.3.13 Software Specifications

- Real Time O.S: KW ProConOS (Up to 16 cycle tasks)
- Programmable Code/Data Size: up to 710 KB

1.4 Dimensions

The following diagrams show the dimensions of the system unit and an I/O unit. All dimensions are in millimeters.

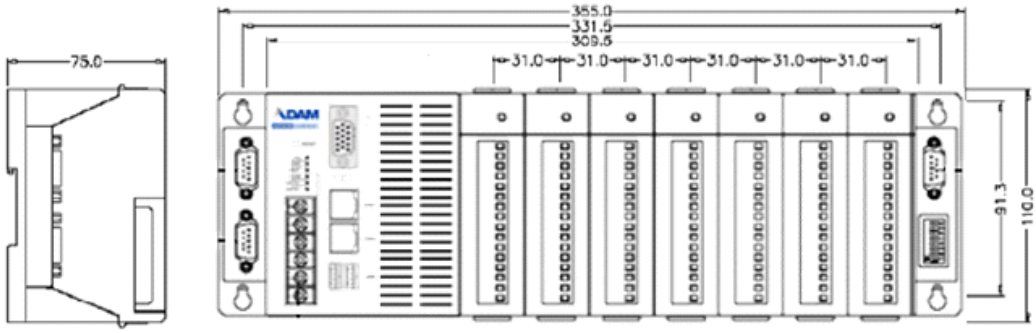


Figure 1.3 ADAM-5560 Dimensions

1.5 LED Status

There are two LEDs on the front panel of ADAM-5560 Series Controller. The LEDs indicate operating status, as explained below:

PWR: Power indicator. This LED is on whenever the ADAM-5560 Series Controller is powered on.

RUN: Blinking while project is running, off while project is stopped.

There are two LEDs besides each Ethernet port. The LEDs indicate operating status, as explained below:

TX (Green): This LED blinks whenever the ADAM-5560 Series Controller transmitting data to Ethernet.

Link (Orange): This LED is on whenever the ADAM-5560 Series Controller connecting to Ethernet.

1.6 Limitations

1.6.1 Remote I/O Quantity

ADAM-5560 Series Controller can connect to ADAM-4000 Modbus I/O modules through COM1/COM2/COM3/COM4 RS-485 port by Modbus protocol. (COM2 is also workable if a RS-232 to RS-485 converter is used.) The typical quantity of remote I/O connection is 128.

1.6.2 Modbus/RTU Slave Function

ADAM-5560 Series Controller support Modbus/RTU slave function.

1.6.3 TCP/IP Connections

- Multiprog via Ethernet connection: maximum 4 connections
- Modbus/TCP Server connection: maximum 64 connections
- Modbus/TCP Client connection: maximum 128 connections

1.6.4 Firmware Upgrade Notice

When you would like to upgrade the firmware of ADAM-5560 Series Controller, please do contact with Advantech Technical Support Team for support. Wrong procedures will possibly cause potential problem to your system.

1.6.5 Boot-up Time

The boot-up time of ADAM-5560 Series Controller is around 40 seconds.

Chapter 2

Installation

2.1 Overview

This chapter describes how to install an ADAM-5560 Series Controller. A quick hookup scheme is provided that let you easily configure your system before implementing it into your application.

2.2 System Requirements

Before you start installing the ADAM-5560 Series Controller, make sure the system requirements are met as below:

2.2.1 Host Computer Requirements

1. IBM PC compatible computer with Pentium II 350MHz processor.
2. Microsoft Windows 95/98/NT4.0 SP5/Windows 2000 SP2 or Windows XP.
3. At least 64 MB RAM.
4. 200 MB of hard disk space available
5. VGA 256 colors monitor, 800x600 resolutions
6. CD-ROM.
7. Mouse or other pointing devices.
8. One Ethernet port

2.2.2 ADAM-5560 Series Requirements

1. 1 x ADAM-5560 Series main unit, i.e., ADAM-5560CE or ADAM-5560KW
2. ADAM-5560 Series User's Manual
3. One Advantech Multiprog CD.
4. Power supply for ADAM-5560 Series (+10 to +30 VDC unregulated)
5. One Ethernet Hub or Switch like ADAM-6520 or ADAM-6510

2.2.3 I/O Module Requirements

At least one I/O module is needed to use the system. A variety of I/O modules are available to meet different application requirements. Table 1.2 gives a current listing of these modules for your reference. In following example, we will use ADAM-5051D in Slot 0 and ADAM-5056D in Slot 1 on ADAM-5560KW.

2.3 Hardware Installation

2.3.1 Selecting I/O Module

To organize an ADAM-5560 Series control system, you need to select I/O modules to interface the main unit with field devices or processes that you have previously determined. There are several things should be considered when you select the I/O modules.

- **What type of I/O signal is applied in your system?**
- **How many I/O is required to your system?**
- **How will you concentrate the I/O points of an entire process?**
- **What is the required voltage range for each I/O module?**
- **What isolation environment is required for each I/O module?**
- **What are the noise and distance limitations for each I/O module?**

Refer to discrete & analog I/O module selection guidelines as below.

Table 2.1: Discrete and Analog I/O Selection Guidelines

Choose this type of I/O module:	For these types of field devices or operations (examples):	Explanation:
Discrete input module and block I/O module	Selector switches, push buttons, photoelectric eyes, limit switches, circuit breakers, proximity switches, level switches, motor starter contacts, relay contacts, thumbwheel switches	Input modules sense ON/OFF or OPENED/CLOSED signals. Discrete signals can be either AC or DC.
Discrete output module and block I/O module	Alarms, control relays, fans, lights, horns, valves, motor starters, solenoids	Output module signals interface with ON/OFF or OPENED/CLOSED devices. Discrete signals can be either AC or DC.
Analog input module	Thermocouple signals, RTD signals, temperature transducers, pressure transducers, load cell transducers, humidity transducers, flow transducers, potentiometers.	Convert continuous analog signals into input values
Analog output module	Analog valves, actuators, chart recorders, electric motor drives, analog meters	Interpret output value to analog signals (generally through transducers) for field devices.

Advantech provides 28 types of ADAM-5560 I/O modules for various applications so far. The Table 1.2 will help you to select the ADAM-5560 I/O modules quickly and easily.

Module		ADAM-5013	ADAM-5017	ADAM-5017UH	ADAM-5018	ADAM-5024
Analog Input	Resolution	16 bit	16 bit	12 bit	16 bit	-
	Input Channel	3	8	8	7	-
	Sampling Rate	10	10	8K (Total)	10	-
	Voltage Input	-	±150 mV ±500 mV ±1 V ±5 V ±10 V	±10 V 0~10V 0~20mV	±15 mV ±50 mV ±100 mV ±500 mV ±1 V ±2.5 V	-
	Current Input	-	±20 mA	4~20mA	±20 mA	-
	Direct Sensor Input	Pt or Ni RTD	-	-	J, K, T, E, R, S, B	-
Analog Output	Resolution	-	-	-	-	12 bit
	Voltage Output	-	-	-	-	0~10 V
	Current Output	-	-	-	-	0~20 mA 4~20 mA
Digital Input and Digital Output	Digital Input Channels	-	-	-	-	-
	Digital Output Channels	-	-	-	-	-
Counter (32-bit)	Channels	-	-	-	-	-
	Input Frequency	-	-	-	-	-
	Mode	-	-	-	-	-
Isolation		3000 VDC	3000 VDC	3000 VDC	3000 VDC	3000 VDC

Module		ADAM-5050	ADAM-5051	ADAM-5051D	ADAM-5051S
Analog Input	Resolution	-	-	-	-
	Input Channel	-	-	-	-
	Sampling Rate	-	-	-	-
	Voltage Input	-	-	-	-
	Current Input	-	-	-	-
	Direct Sensor Input	-	-	-	-
Analog Output	Resolution	-	-	-	-
	Voltage Output	-	-	-	-
	Current Output	-	-	-	-
Digital Input and Digital Output	Digital Input Channels	16 DIO (bit-wise selectable)	16	16 W/LED	16 W/LED
	Digital Output Channels		-	-	-
Count-er (32-bit)	Channels	-	-	-	-
	Input Frequency	-	-	-	-
	Mode	-	-	-	-
Isolation		-	-	-	2500 VDC

Module		ADAM-5052	ADAM-5055S	ADAM-5056	ADAM-5056D	ADAM-5056S / 5056SO
Analog Input	Resolution	-	-	-	-	-
	Input Channel	-	-	-	-	-
	Sampling Rate	-	-	-	-	-
	Voltage Input	-	-	-	-	-
	Current Input	-	-	-	-	-
	Direct Sensor Input	-	-	-	-	-
Analog Output	Resolution	-	-	-	-	-
	Voltage Output	-	-	-	-	-
	Current Output	-	-	-	-	-
Digital Input and Digital Output	Digital Input Channels	8	8 W/LED	-	-	-
	Digital Output Channels	-	8 W/LED	16	16 W/LED	16 W/LED
Count-er (32-bit)	Channels	-	-	-	-	-
	Input Frequency	-	-	-	-	-
	Mode	-	-	-	-	-
Isolation		5000 V_{RMS}	2500 V_{DC}	-	-	2500V_{DC}

Module		ADAM-5060	ADAM-5069
Analog Input	Resolution	-	-
	Input Channel	-	-
	Sampling Rate	-	-
	Voltage Input	-	-
	Current Input	-	-
	Direct Sensor Input	-	-
Analog Output	Resolution	-	-
	Voltage Output	-	-
	Current Output	-	-
Digital Input and Digital Output	Digital Input Channels	-	-
	Digital Output Channels	6 relay (2 form A/ 4 form C)	8 power relay (8 form A)
Counter (32-bit)	Channels	-	-
	Input Frequency	-	-
	Mode	-	-
RS-232	Channels	-	-
Isolation		-	-

Module	ADAM-5030
SD Card Slot	2
USB 2.0 Slot	2

2.3.2 Selecting Power Supply Module

ADAM-5560 Series Controller works under unregulated power source between +10 and +30 VDC. When you arrange different I/O modules on ADAM-5560 Series Controller's backplane, it may require comparable power supply. Use the following steps as guidelines for selecting a power supply for your ADAM-5000 Series control system.

Refer to Table 2.2 to check the power consumption of ADAM-5000 Series Controller and each I/O module.

Table 2.2: Power Consumption of ADAM-5000 series (Main Units)

Main Units	Description	Power Consumption
ADAM-5000/485	Distributed Data Acquisition and Control System based on RS-485	1.0 W
ADAM-5000	Distributed Data Acquisition and Control System based on RS-485	4.0 W
ADAM-5000/TCP	Distributed Data Acquisition and Control System based on Ethernet	5.0 W
ADAM-5510	PC-Based Programmable Controller (With Battery Backup)	1.0 W
ADAM-5510M	Enhanced PC-Based Programmable Controller (With Battery Backup)	1.2 W
ADAM-5511	PC-Based Programmable Controller with Modbus	1.0 W
ADAM-5510E	8-slot PC-Based Programmable Controller	1.2 W
ADAM-5510/TCP	Ethernet-enabled PC-Based Programmable Controller	2.0 W
ADAM-5510E/TCP	8-slot Ethernet-enabled PC-Based Programmable Controller	2.0 W
ADAM-5510KW	PC-based SoftLogic Controller	1.2 W
ADAM-5510EKW	8-slot PC-based SoftLogic Controller	1.2 W
ADAM-5510EKW/TP	8-slot Ethernet-enabled SoftLogic Controller	2.0 W
ADAM-5560	8-slot Programmable Automation Controller	17 W

Table 2.3: Power Consumption of ADAM-5000 series (IO Modules)		
ADAM-5013	3-Channel RTD Input Module	1.1 W
ADAM-5017	8-Ch Analog Input Module (mV, mA or High Voltage)	1.25 W
ADAM-5017UH	8-CH Ultra High speed Analog Input Module (mV, mA or High Voltage)	2.2 W
ADAM-5018	7-Channel Thermocouple Input Module (mV, V, mA, Thermocopule)	0.63 W
ADAM-5024	4-Channel Analog Output Module (V, mA)	2.9 W
ADAM-5050	16-Channel Universal DIO	1.2 W
ADAM-5051	16-Channel Digital Input Module	0.53 W
ADAM-5051D	16-Channel Digital Input w/LED Module	0.84 W
ADAM-5056S	16-Channel Isolated Digital Input w/LED Module	0.8 W
ADAM-5056SO	16-Channel Digital Input w/LED Module	0.84 W
ADAM-5052	8-Channel Isolated DI	0.27 W
ADAM-5055S	16-Channel Isolated DIO w/LED Module	0.68 W
ADAM-5056	16-Channel Digital Output Module	0.53 W
ADAM-5056D	16-Channel Digital Output w/LED Module	0.84 W
ADAM-5056S	16-Channel Isolated Digital Output w/LED Module	0.6 W
ADAM-5060	6-Ch Relay Output Module (2 of Form A, 4 of Form C)	1.8 W
ADAM-5068	8-Channel Relay Output Module (8 Form A)	1.8 W
ADAM-5069	8-Channel Power Relay Output Module (8 Form A)	2.2 W
ADAM-5202	2-Ring AMONet Motion Control Module	2.5 W

Calculate the Summary of the whole system's power consumption.

For example, there are following items in your system.

ADAM-5550KW * 3 & ADAM-5024 * 2 & ADAM-5017 * 4 &

ADAM-5068 * 2 & ADAM-5056D * 2

The power consumption is:

17 W * 3 + 2.9 W * 2 + 1.25 * 4 + 1.8 W * 2 + 0.84 W * 2 = 67.08 W

Select a suitable power supply from Table 2.4 or other comparable power resource for system operation.

Table 2.4: Power Supply Specification Table

Specification	PWR-242	PWR-243	PWR-244
Input			
Input Voltage	90 ~ 264 VAC	85 ~ 132 VAC 170 ~ 264 VAC	100 ~ 240 VAC
Input Frequency	47 ~ 63 Hz	47 ~ 63 Hz	47 ~ 63 Hz
Input Current	1.2 A max.	1.4 A max	25 A/110 VAC 50 A/220 VAC (Inrush current)
Short Protection	Yes	Yes	Yes
Output			
Output Voltage	+24 VDC	+24 VDC	+24 VDC
Output Current	2.1 A	3 A	4.2 A
Overload Protection	Yes	Yes	Yes
General			
Dimension	181mm x 113 mm x 60 mm (L x W x H)	181mm x 113 mm x 60 mm (L x W x H)	181mm x 113 mm x 60 mm (L x W x H)
Operating Temperature	0 ~ 50°C (32 ~ 122°F)	0 ~ 50°C (32 ~ 122°F)	0 ~ 50°C (32 ~ 122°F)
DIN-rail Mountable	Yes	No	No

2.3.3 Install Main Unit and Modules

While inserting modules into the system, align the PC board of the module with the grooves on the top and bottom of the system. Push the module straight into the system until it is firmly seated in the backplane connector. Once the module is inserted into the system, push in the retaining clips (located at the top and bottom of the module) to firmly secure the module to the system.

2.3.4 I/O Slots and I/O Channel Numbering

The ADAM-5560 Series provides 7 slots for I/O modules. The I/O slots are numbered 0 through 6, and the channel numbering of any I/O module in any slot starts from 0. For example, the ADAM-5017 is an 8-channel analog input module. Its input channel numbering is 0 through 7.

2.3.5 Mounting

The ADAM-5560 Series Controller can be installed on a panel or on a DIN rail.

2.3.5.1 Panel Mount

Mount the system on the panel horizontally to provide proper ventilation. You cannot mount the system vertically, upside down or on a flat horizontal surface. A standard #7 tatting screw (4 mm diameter) should be used.

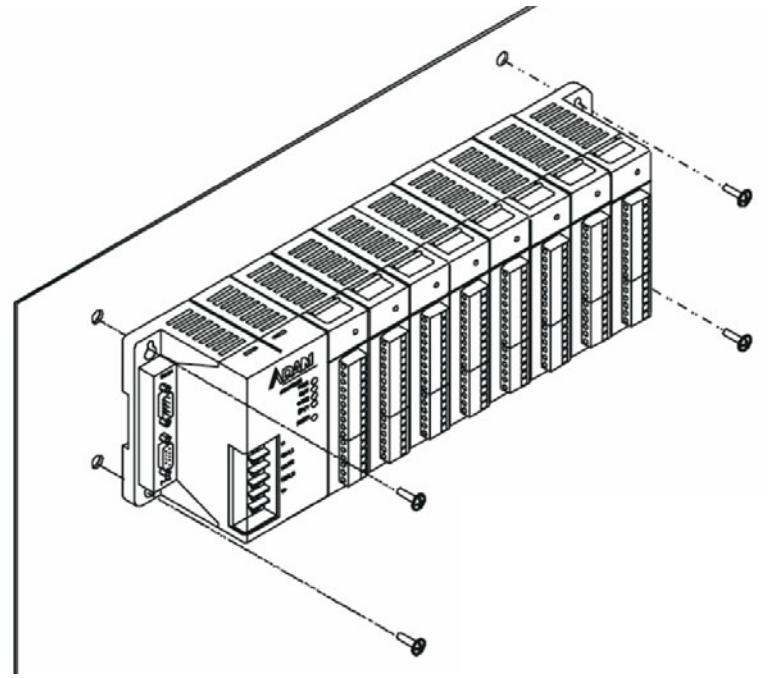


Figure 2.1 Panel Mount for ADAM-5560 Series

2.3.5.2 DIN-rail Mounting

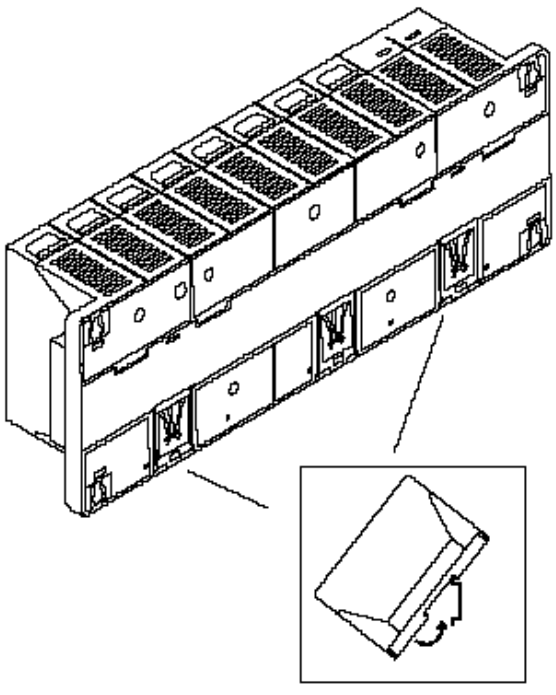


Figure 2.2 DIN-rail Mounting

The system can also be secured to the cabinet by using mounting rails. If you mount the system on a rail, you should also consider using end brackets at each end of the rail. The ended brackets help keep the system from sliding horizontally along the rail. This minimizes the possibility of accidentally pulling the wiring loose. If you examine the bottom of the system, you will notice two small retaining clips. To secure the system to a DIN rail, place the system on to the rail and gently push up on the retaining clips. The clips lock the system on the rail. To remove the system, pull down on the retaining clips, lift up on the base slightly, and pull it away from the rail.

2.3.6 Jumper and DIP Switch Settings

This section tells you how to set the jumpers and DIP switches to configure your ADAM-5560 Series Controller. It gives the system default configuration and your options for each jumper and dip switch. The backplane has one 8-pin DIP switch and twelve jumpers on it.

2.3.6.1 RS-232/485 Selectable Jumper Setting

Following figure shows the COM1 to COM4 location.

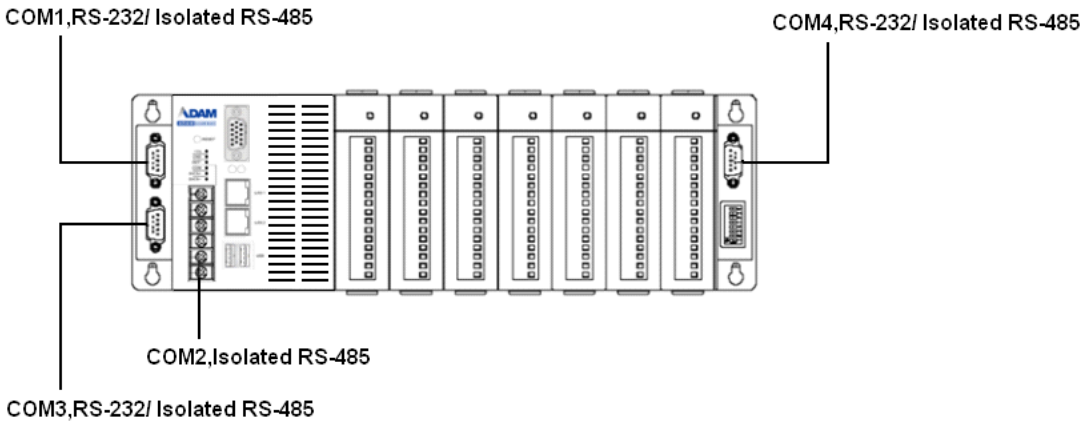


Figure 2.3 COM Port Location

The Communication mode of COM1, COM3 and COM4 are set by jumpers on the backplane. Please refer to Figure 2.4 to get the jumper locations.

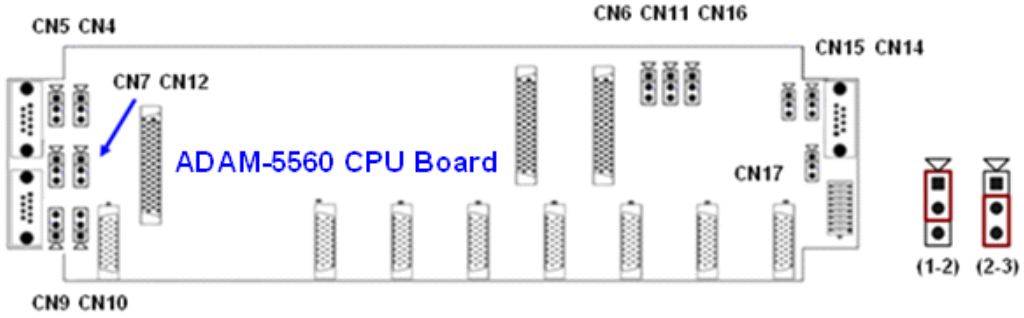


Figure 2.4 COM1/COM4 RS-232/485 Settings

COM1 Jumper Setting

The Communication port of COM1 is set by CN4, CN5, CN6 (Mode) and CN7 (Terminal Resistor).

COM1 Setting	CN4	CN5	CN6
RS-232 (Default)	(1-2)	(1-2)	(1-2)
RS-485	(2-3)	(2-3)	(2-3)

COM1 RS-485 TR Setting	CN7
120 ohm	(1-2)
300 ohm	(2-3)

Figure 2.5 COM1 RS-232/485 and Terminal Resistor Settings

COM3 Jumper Setting

The Communication port of COM3 is set by CN9, CN10, CN11 (Mode) and CN12 (Terminal Resistor).

COM3 Setting	CN9	CN10	CN11
RS-232 (Default)	(1-2)	(1-2)	(1-2)
RS-485	(2-3)	(2-3)	(2-3)

COM3 RS-485 TR Setting	CN12
120 ohm	(1-2)
300 ohm	(2-3)

Figure 2.6 COM3 RS-232/485 and Terminal Resistor Settings

COM4 Jumper Setting

The Communication port of COM4 is set by CN14, CN15, CN16 (Mode) and CN1 7(Terminal Resistor).

COM4 Setting	CN14	CN15	CN16
RS-232 (Default)	(1-2)	(1-2)	(1-2)
RS-485	(2-3)	(2-3)	(2-3)

COM4 RS-485 TR Setting	CN17
120 ohm	(1-2)
300 ohm	(2-3)

Figure 2.7 COM4 RS-232/485 and Terminal Resistor Settings

2.3.6.2 DIP Switch Setting

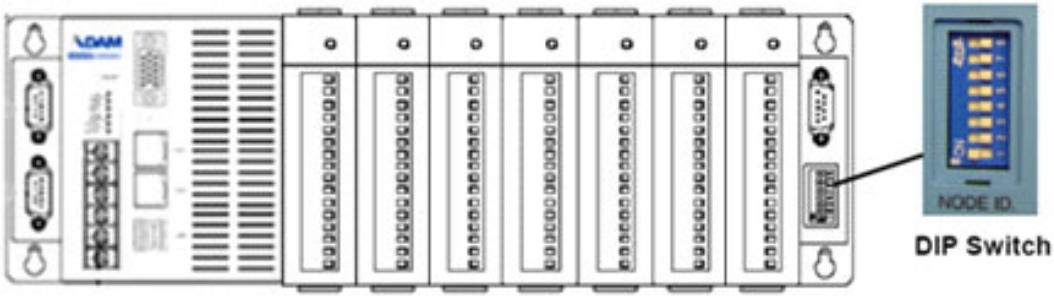


Figure 2.8 ADAM-5560 Series DIP Switch

Device ID Setting:

You can set up your device ID by changing DIP Switch 1-8. The available ID for ADAM-5560 Series Controller is from 0 to 255. Please refer to the Table 2.6 Device ID DIP Switch Table to set up your Device ID.

Table 2.5: Device ID DIP Switch Table

DIP 8 (2^7)	DIP 7 (2^6)	DIP 6 (2^5)	DIP 5 (2^4)	DIP 4 (2^3)	DIP 3 (2^2)	DIP 2 (2^1)	DIP 1 (2^0)	Device ID
Off	Off	Off	Off	Off	Off	Off	Off	0
Off	Off	Off	Off	Off	Off	Off	On	1
Off	Off	Off	Off	Off	Off	On	Off	2
Off	Off	Off	Off	Off	Off	On	On	3
Off	Off	Off	Off	Off	On	Off	Off	4
Off	Off	Off	Off	Off	On	Off	On	5
Off	Off	Off	Off	Off	On	On	Off	6
Off	Off	Off	Off	Off	On	On	On	7
Off	Off	Off	Off	On	Off	Off	Off	8
...	...	...	...	...	...	...	...	...
On	On	On	On	On	On	Off	Off	252
On	On	On	On	On	On	Off	On	253
On	On	On	On	On	On	On	Off	254
On	On	On	On	On	On	On	On	255

2.3.7 COM Port Pin Assignments

Pin No.	Description
Pin 1	DCD
Pin 2	Rx
Pin 3	Tx
Pin 4	DTR
Pin 5	GND
Pin 6	DSR
Pin 7	RTS
Pin 8	CTS
Pin 9	RI

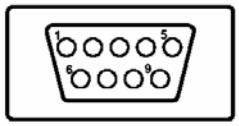


Figure 2.9 RS-232 Port Pin Assignment

Pin No.	Description
Pin 1	DATA-
Pin 2	No Connection
Pin 3	No Connection
Pin 4	DATA+
Pin 5	No Connection
Pin 6	No Connection
Pin 7	No Connection
Pin 8	No Connection
Pin 9	No Connection

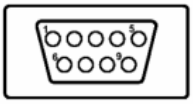


Figure 2.10 RS-485 Port Pin Assignment

2.4 System Wiring and Connections

This section provides basic information on wiring the power supply, I/O modules and communication port connection.

2.4.1 Power Supply Wiring

Although the ADAM-5560 Series Controller is designed for a standard industrial unregulated 24 V_{DC} power supply, they accept any power unit that supplies within the range of +10 to +30 V_{DC}. The power supply ripple must be limited to 200 mV peak-to-peak, and the immediate ripple voltage should be maintained between +10 and +30 V_{DC}. Screw terminals +Vs and GND are for power supply wiring.

Note! *The wires used should be sized at least 2 mm.*

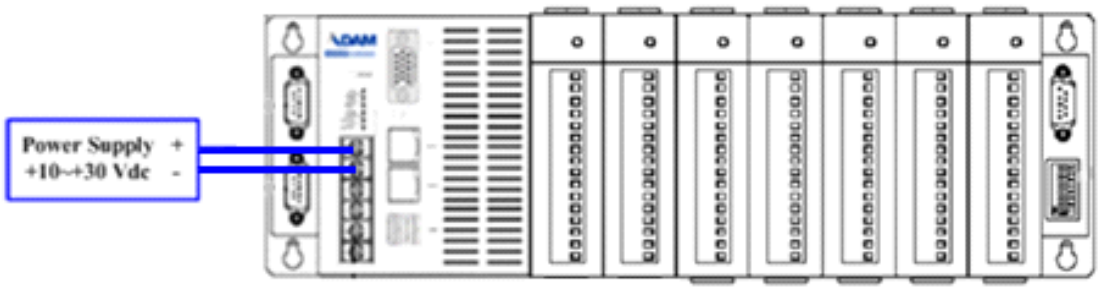


Figure 2.11 ADAM-5560 Series Controller Power Wiring

2.4.2 I/O Module Wiring

The system uses a plug-in screw terminal block for the interface between I/O modules and field devices. The following information must be considered when connecting electrical devices to I/O modules.

1. The terminal block accepts wires from 0.5 mm 2 to 2.5 mm.
2. Always use a continuous length of wire. Do not combine wires to make them longer.
3. Use the shortest possible wire length.\
4. Use wire trays for routing where possible.
5. Avoid running wires near high energy wiring.
6. Avoid running input wiring in close proximity to output wiring where possible.
7. Avoid creating sharp bends in the wires.

2.4.3 Connection of Communication Ports

The ADAM-5560 Series Controller has four communication ports. These ports allow you to integrate the remote devices.

2.4.3.1 Remote I/O Wiring

Modbus/RTU Master Function via COM1/COM2/COM4 RS-485:

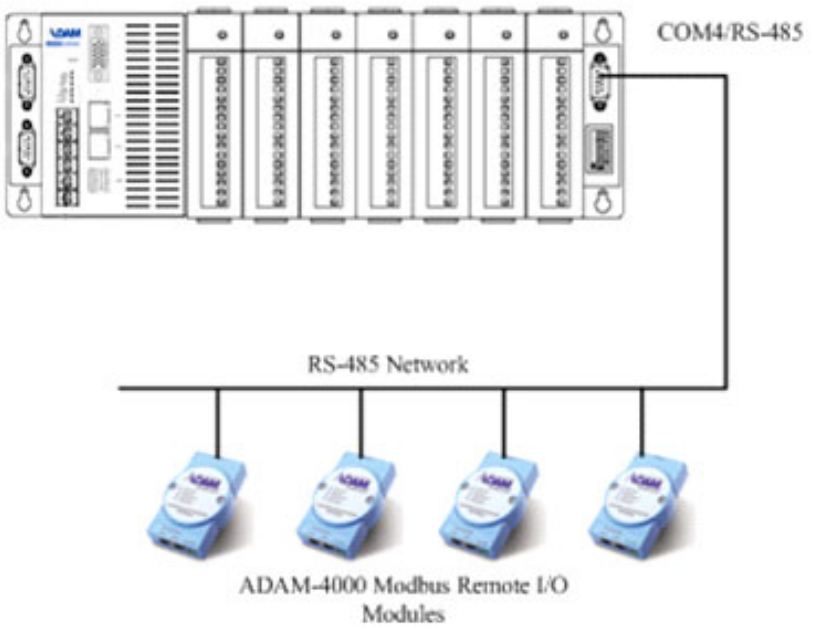


Figure 2.12 Remote I/O Wiring

You can connect typical 128 ADAM-4000 Modbus Remote I/O modules via COM1/COM2/COM4. Please set the COM1 and COM4 as RS-485 mode.

2.4.4 Ethernet Network Connection

The ADAM-5560 Series Controller provides Ethernet interfaces for network integration. Usually, you will need to prepare an ADAM-6520 Ethernet switch or hub for connecting to other network devices as following figure.

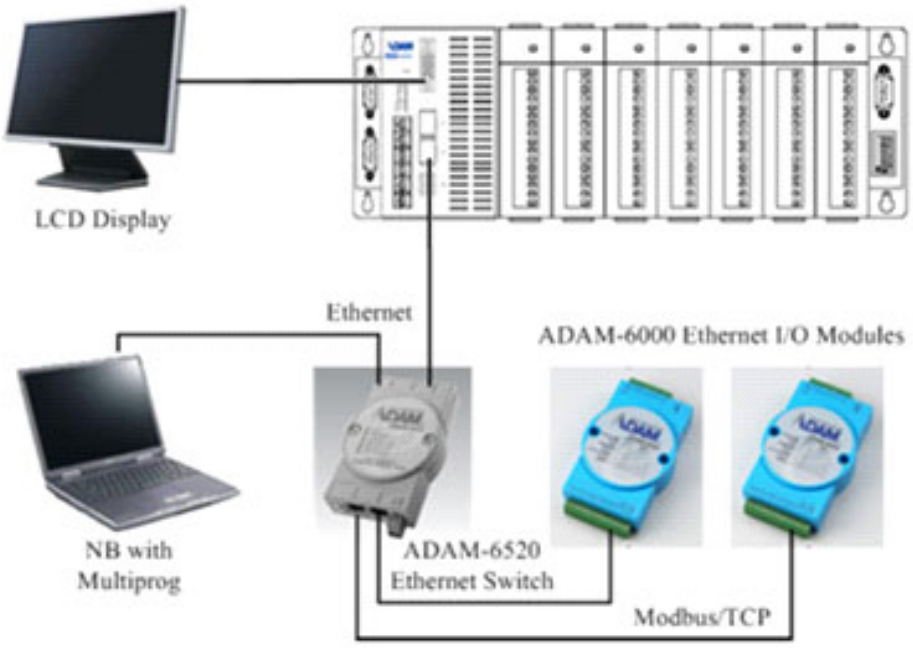


Figure 2.13 Ethernet Network Connection

Chapter 3

Quick Start

This chapter will help you get familiar with ADAM-5560KW Controller and Multiprog Programming Software by following step by step examples.

In this chapter, you need to prepare the system configuration as below.

Main Module:

ADAM-5560KW X1, IP Address: 192.168.1.5

Local I/O Modules:

ADAM-5051D in Slot 0

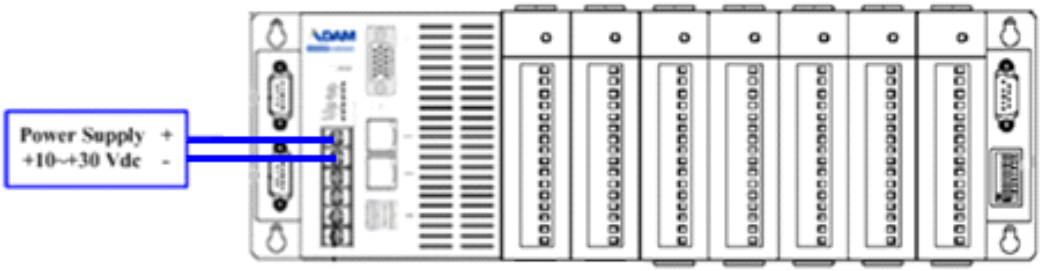
ADAM-5056D in Slot 1

Advantech Multiprog CD:

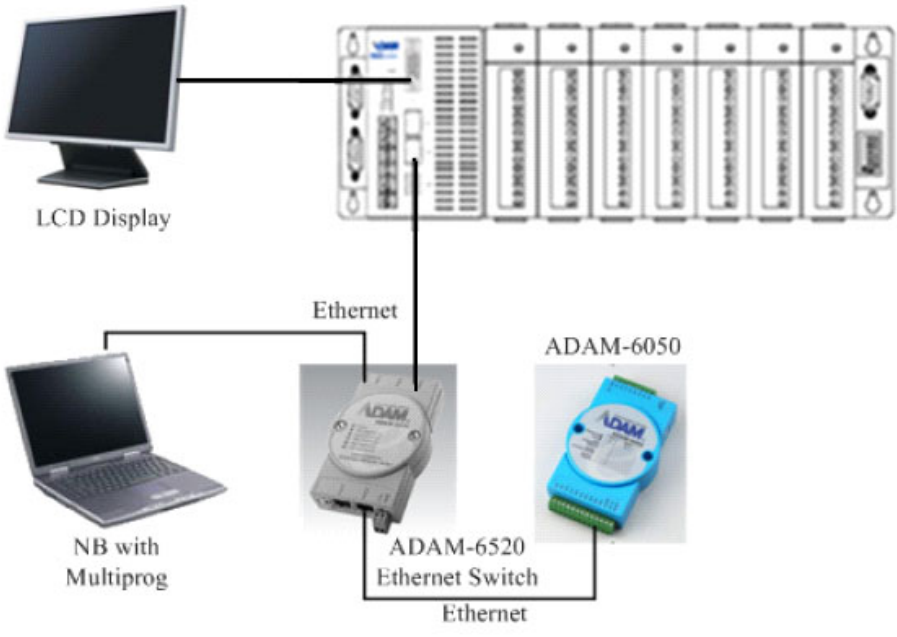
Advantech Multiprog Software with license key.

Note! *In following chapters of step by step examples, you will see the screen of ADAM-5560KW in Windows CE with* ***[PAC Device]*** *description and the screen of PC in Windows XP.*

Power wiring

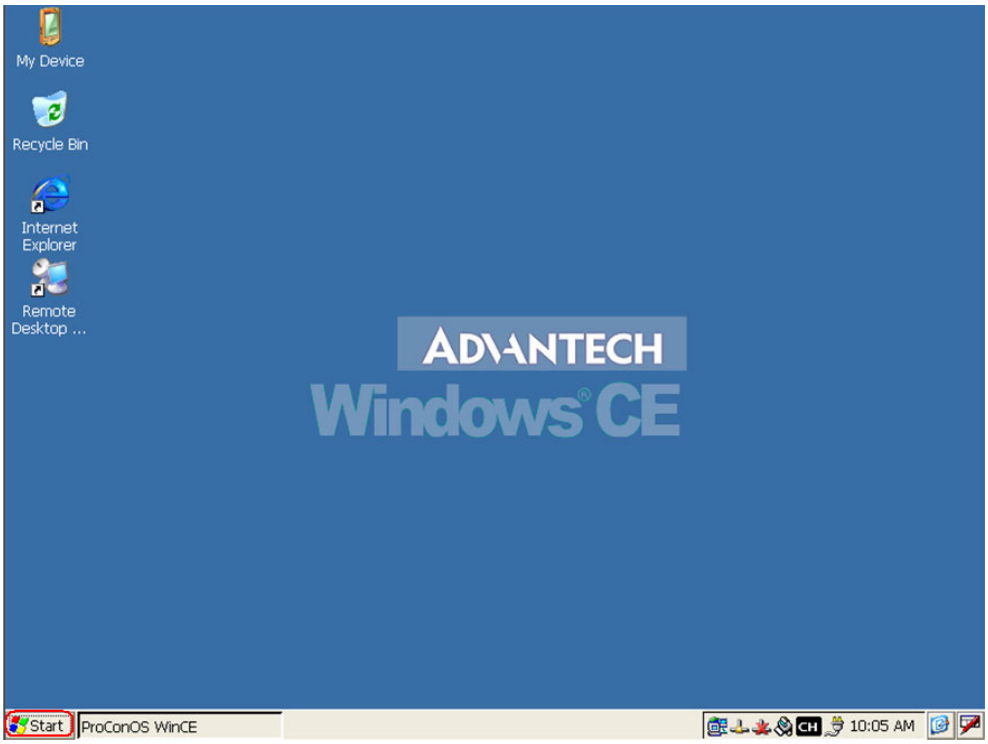


System Wiring

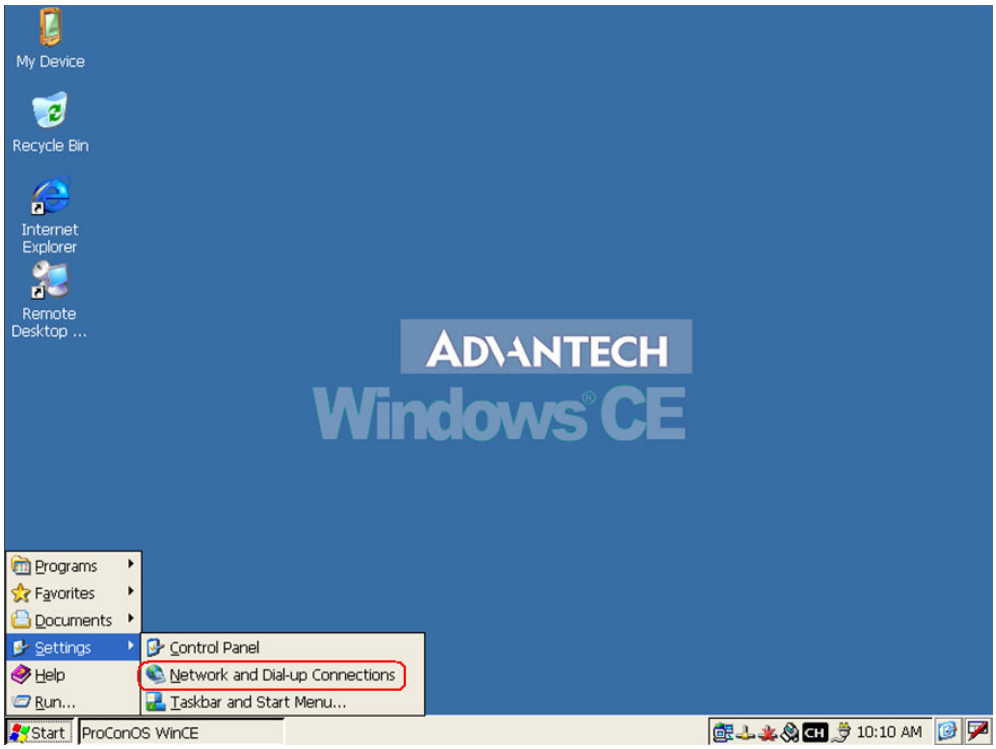


3.1 Set IP Address to ADAM-5560KW

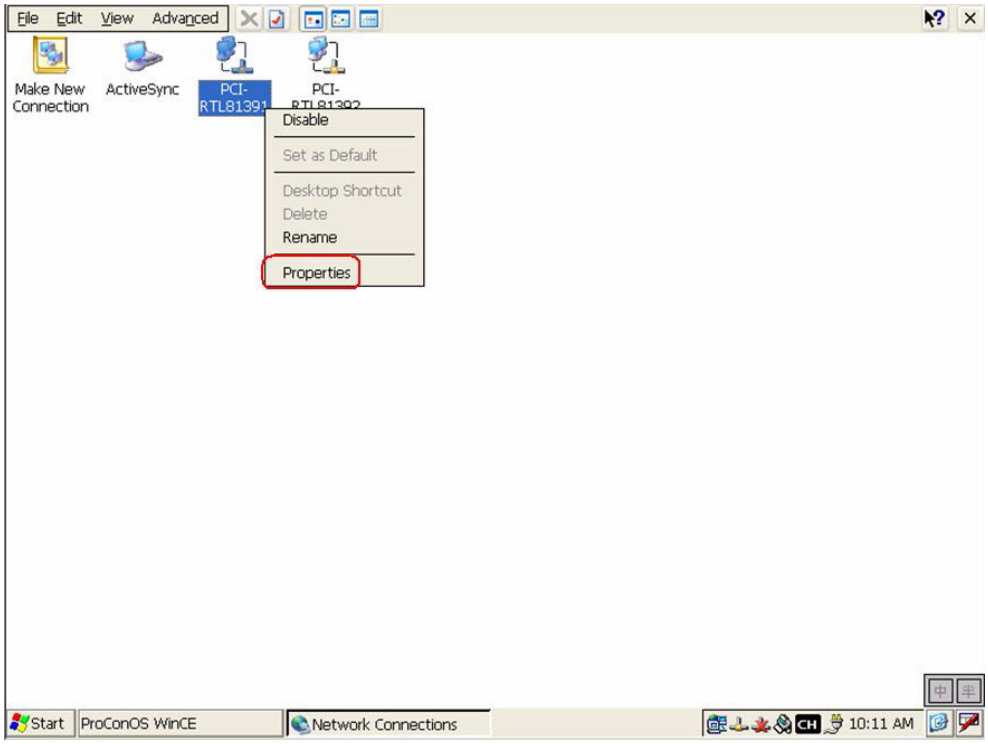
1. ***[PAC Device]*** Power up ADAM-5560KW and click “Start”.



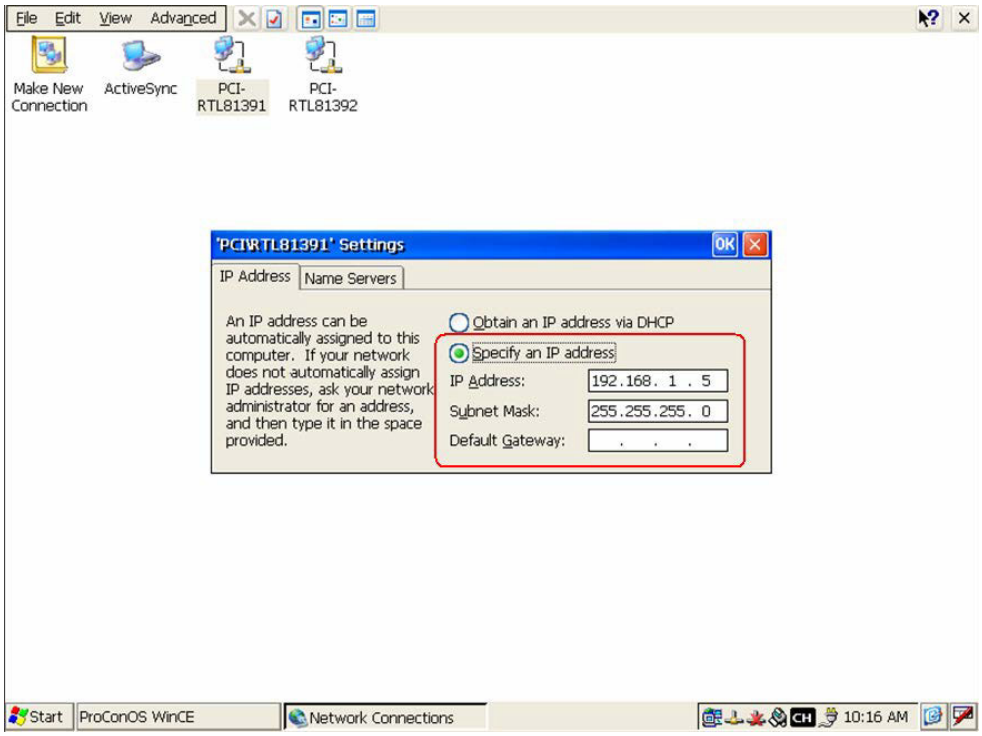
2. ***[PAC Device]*** Click “Settings” and “Network and Dial-up Connections”.



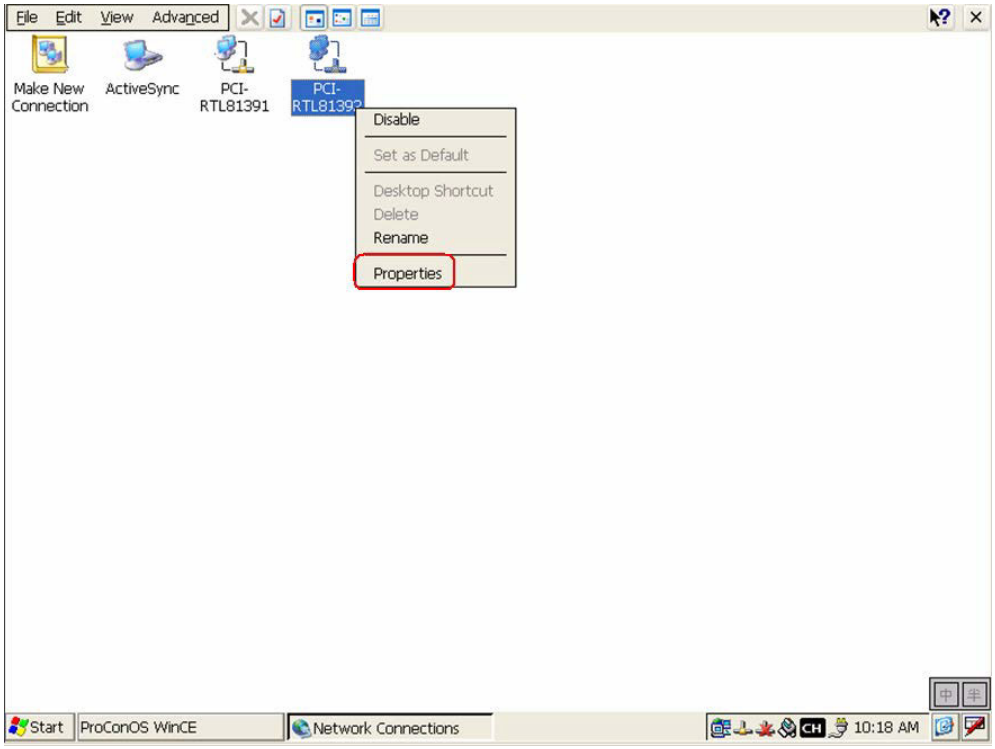
3. ***[PAC Device]*** Right click “PCI-RTL81391” icon and then click “Properties”.



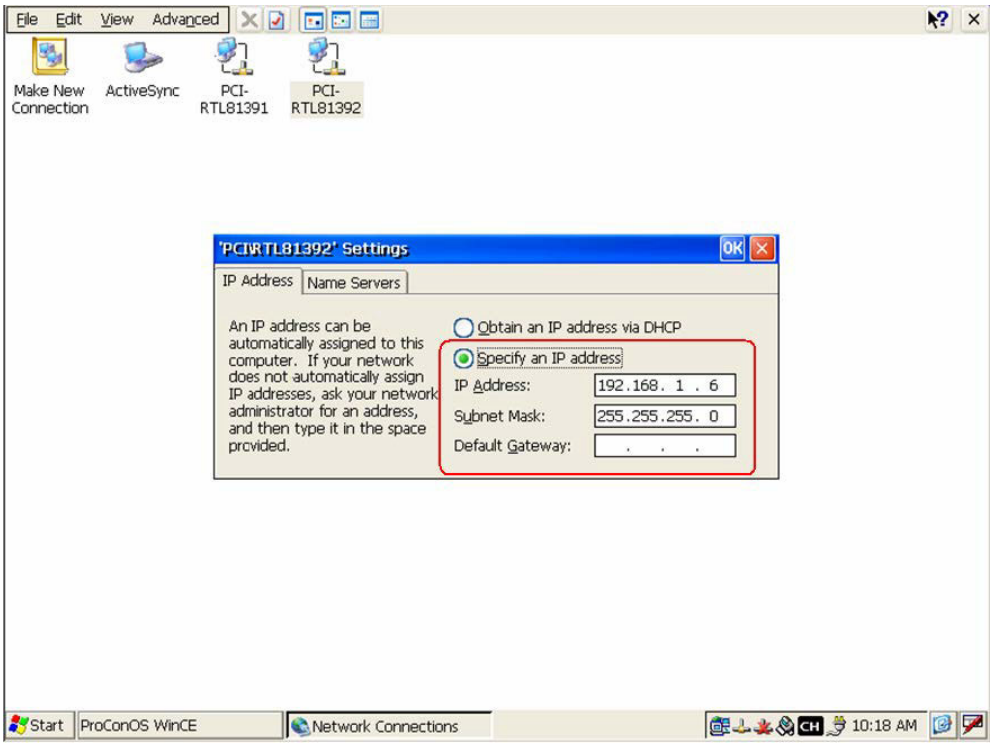
4. ***[PAC Device]*** Type IP Address like “192.168.1.5” and Subnet Mask “255.255.255.0”.



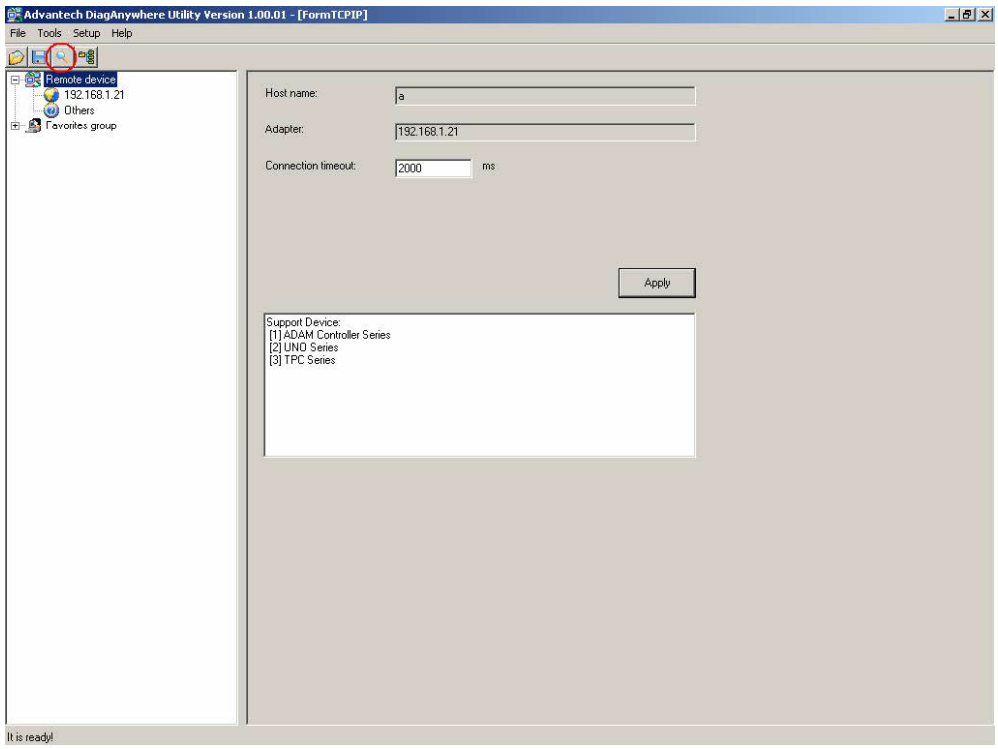
5. ***[PAC Device]*** Right click “PCI-RTL81392” icon and then click “Properties”.



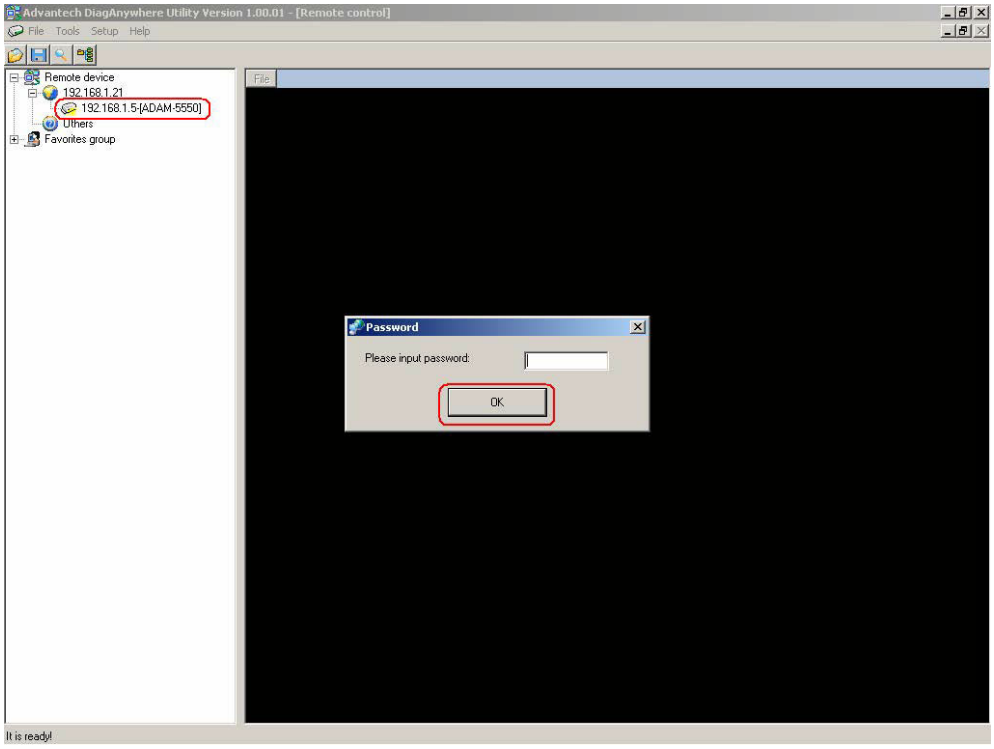
6. ***[PAC Device]*** Type IP Address like “192.168.1.6” and Subnet Mask “255.255.255.0”. Now the IP address configuration has been finished.



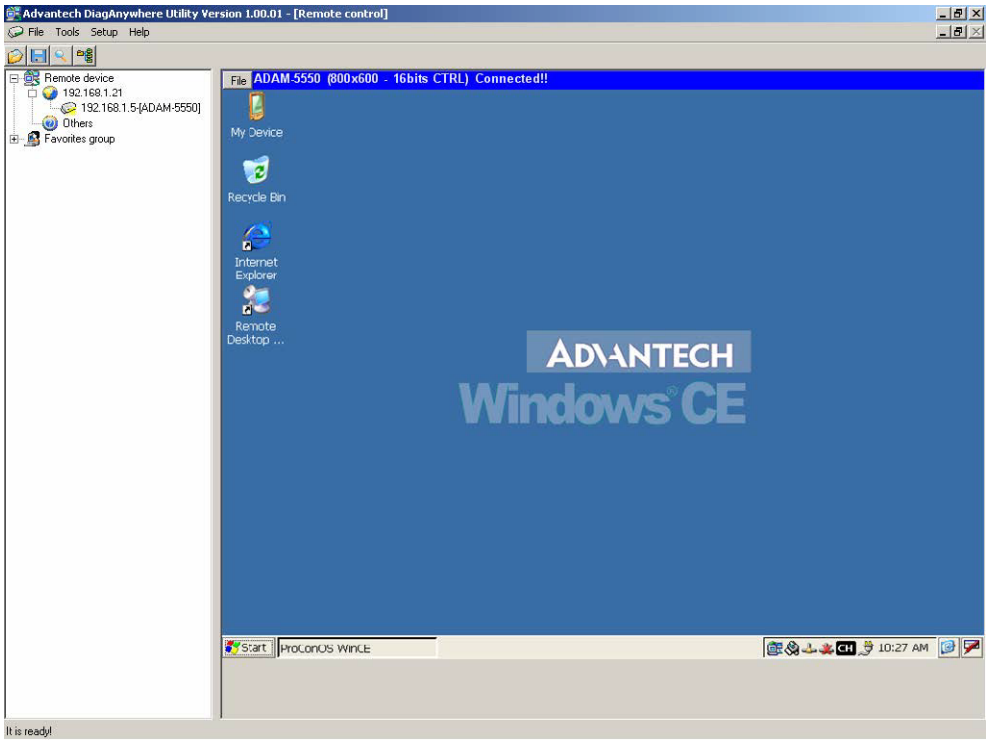
7. If your PC has installed DiagAnywhere Software, you can search the ADAM-5560KW and check the Ethernet connection. Please click the “Remote device” and click “Search” button.



8. Click “ADAM-5560” and then click OK button without entering any password.

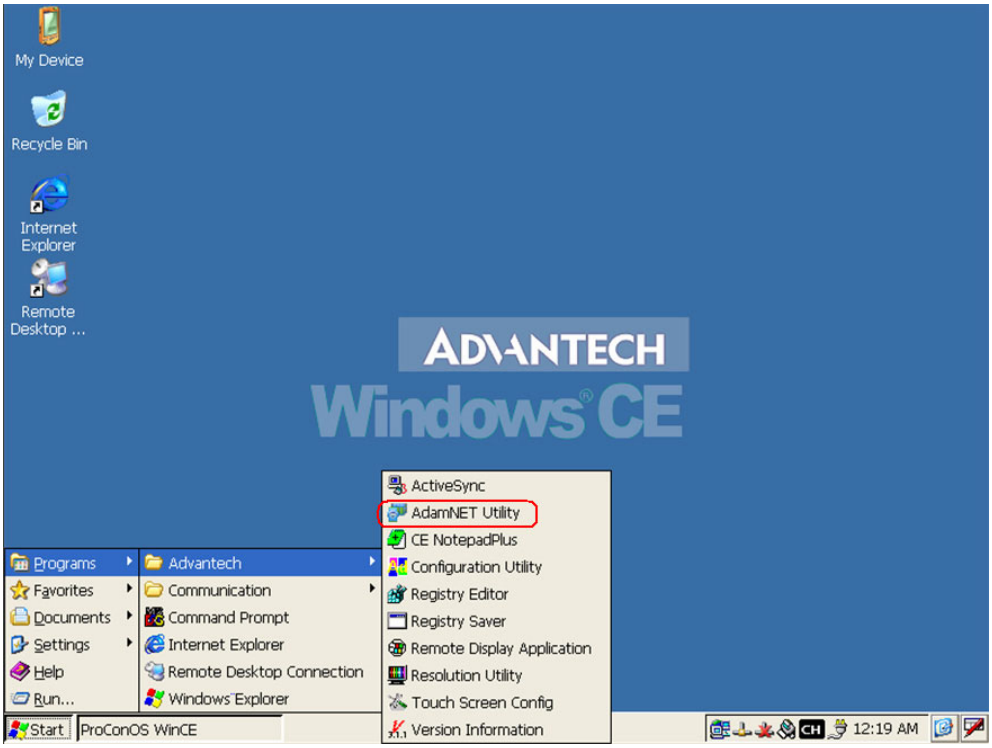


9. The screen of ADAM-5560KW will be shown in the window. Now it is possible to remotely control the ADAM-5560KW by PC's mouse.

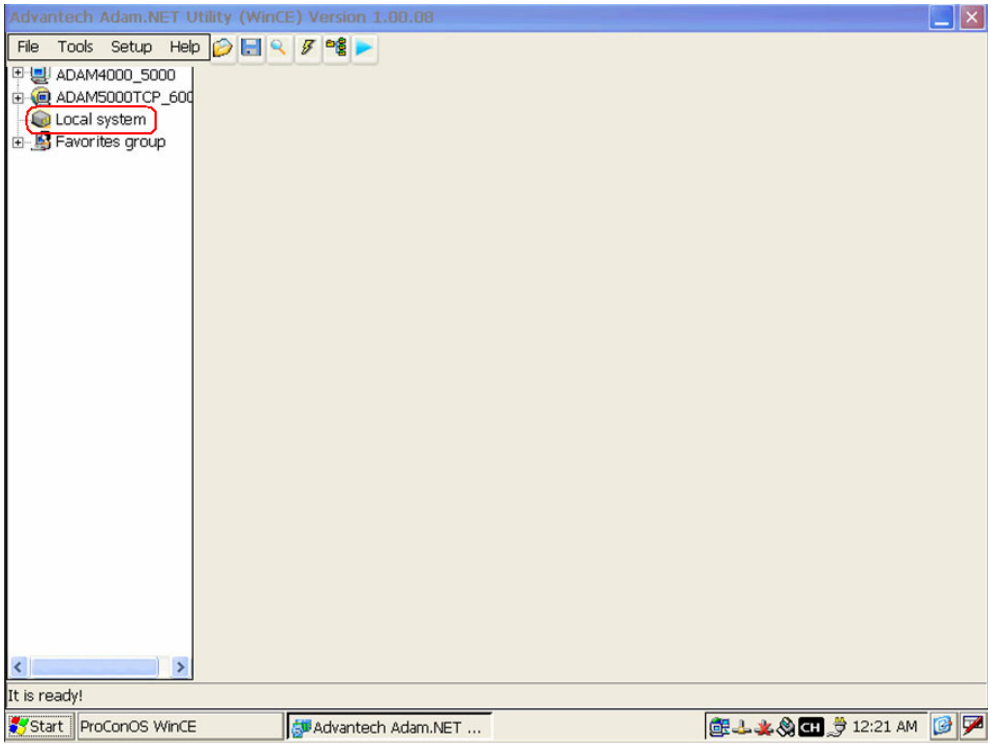


3.2 Configure ADAM-5000 Local I/O

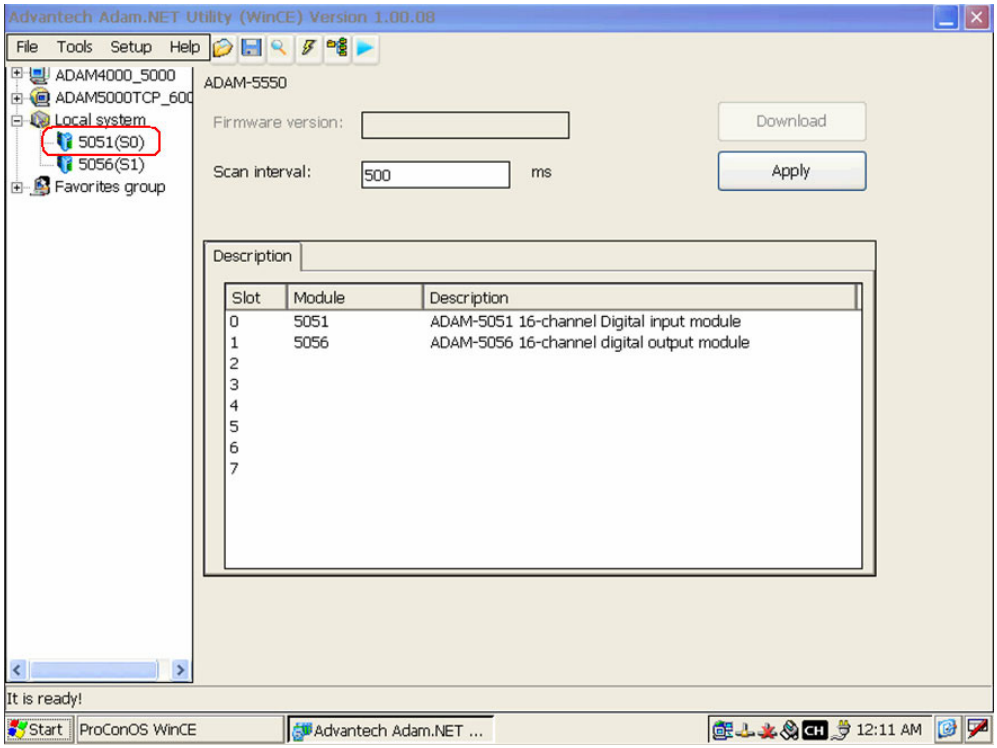
1. ***[PAC Device]*** Click "Start" -> "Programs" -> "Advantech" -> "Adam.NET Utility".



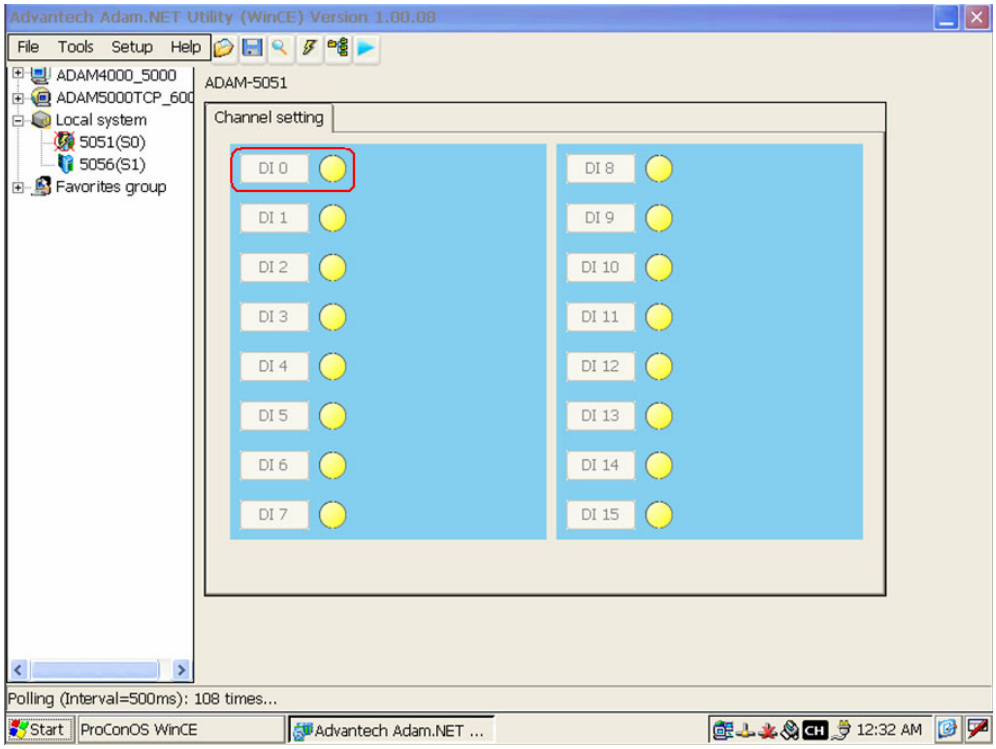
2. ***[PAC Device]*** Click “Local system” to view the local I/O modules.



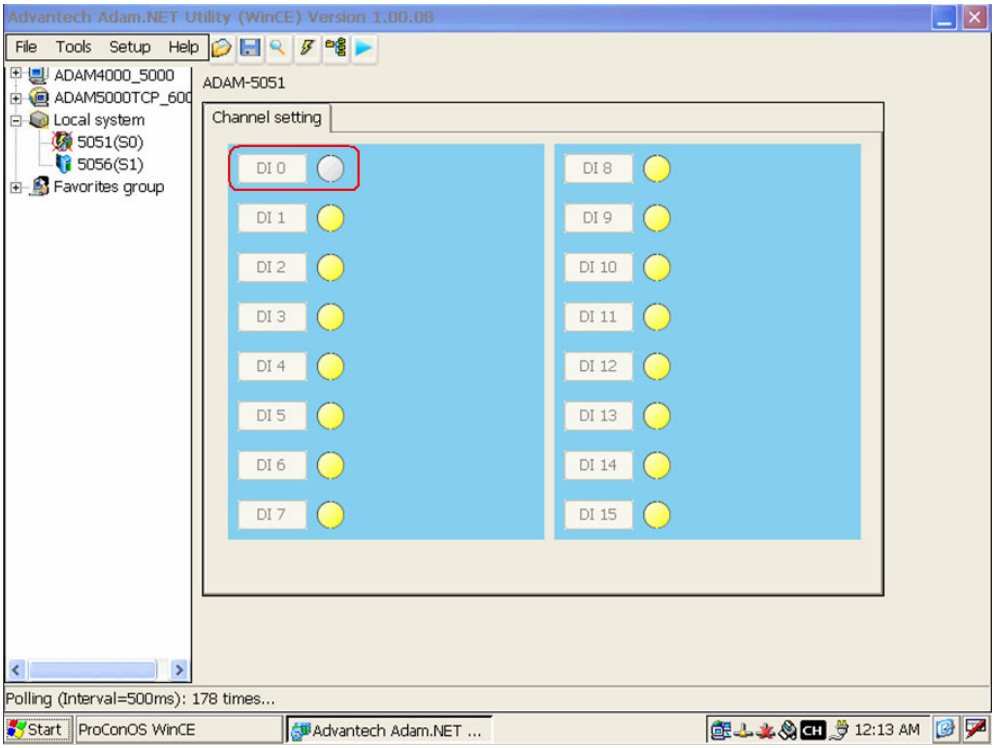
3. ***[PAC Device]*** ADAM-5051 and ADAM-5056 are listed. Select “ADAM-5051”.



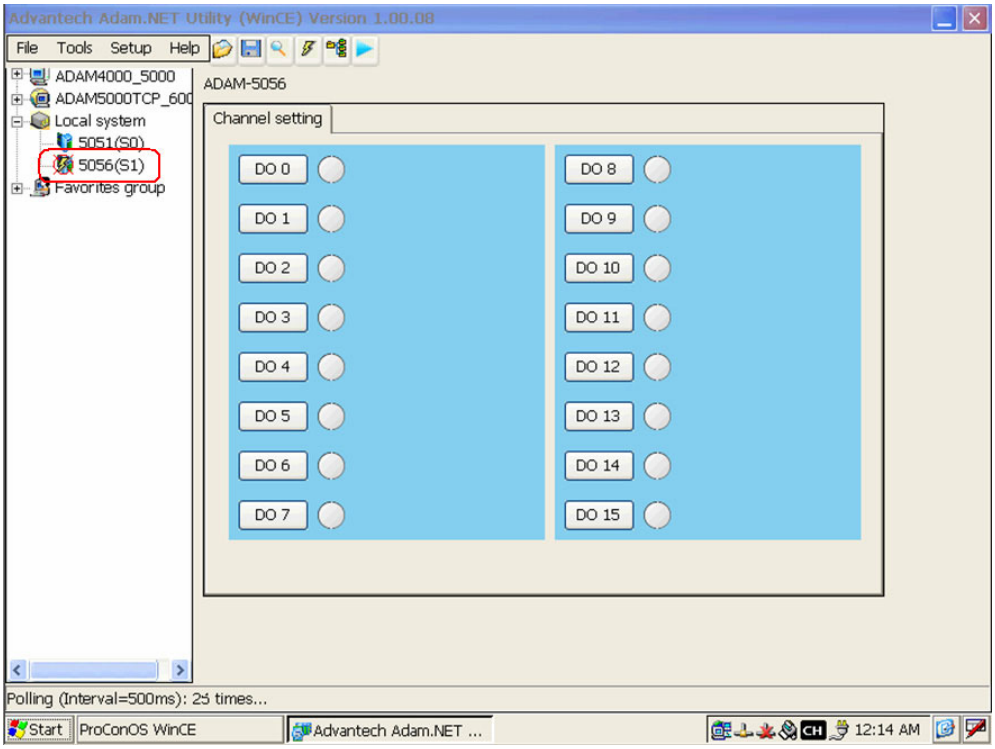
4. ***[PAC Device]*** Check the state of DI 0 is “ON”.



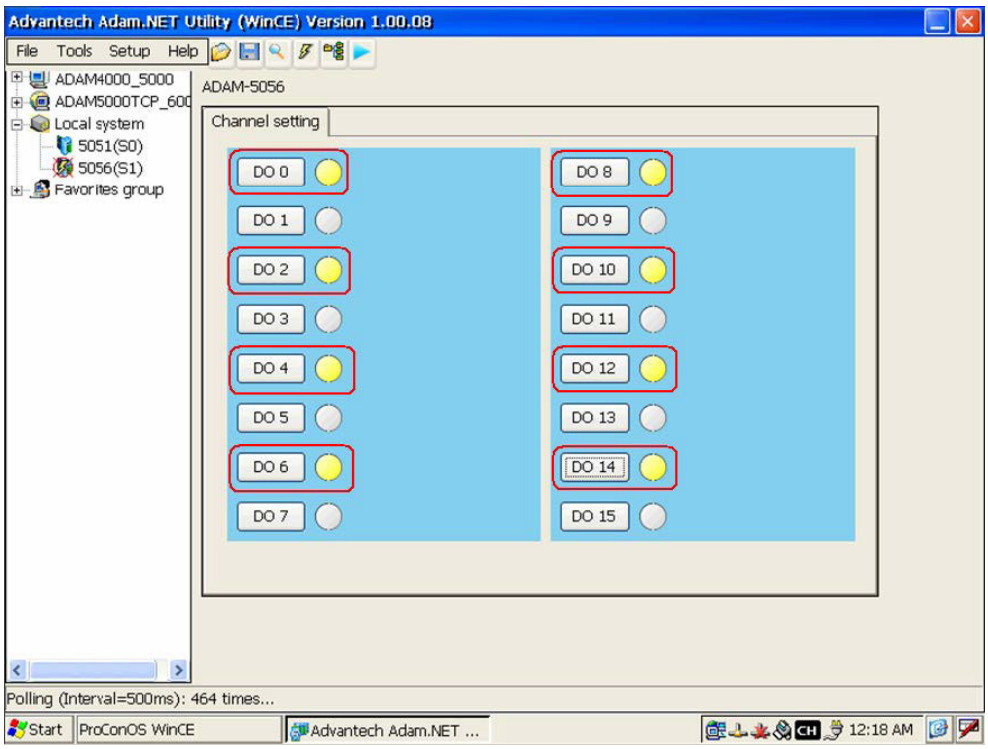
5. ***[PAC Device]*** Change the state of DI 0 to “OFF” and check the display.



6. ***[PAC Device]*** Select “ADAM-5056”.



7. ***[PAC Device]*** Change the state of DO 0, DO 2, DO 4, DO 6, DO 8, DO 10,DO 12, DO 14 to “ON” and check the display.



3.3 Multiprog Installation

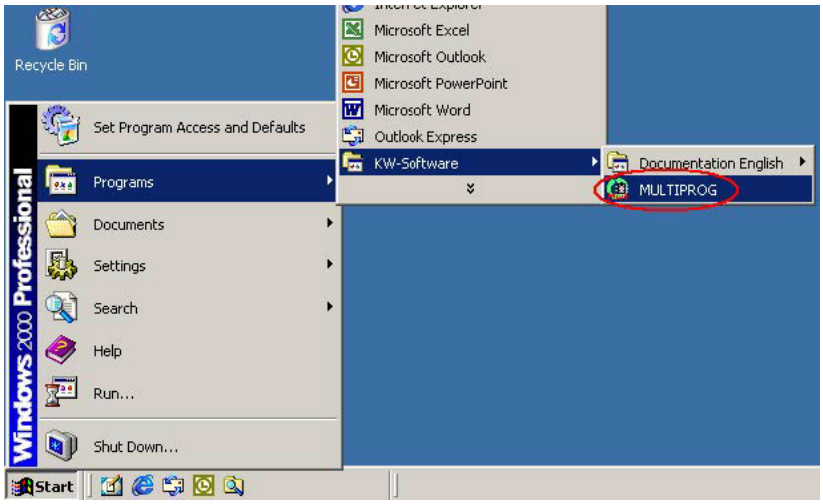
Following will guide you how to setup Multiprog IEC-61131-3 development environment on your PC.

1. Please use your web browser to visit Advantech web site. (www.advantech.com)
2. Type "ADAM-5560" on the search box which is on the right-up corner of the web page.
3. Enter the "Utility" category in the download page.
4. Advantech provide customer a 30 days free trial version Multiprog with full function support. You can download it directly from the web site or from the FTP site.
5. After download all the software package from the web site, please follow the instructions to install them one by one to setup the development environment.
6. Please contact your sales representative to buy the license, Advantech will send you a letter with registration code.

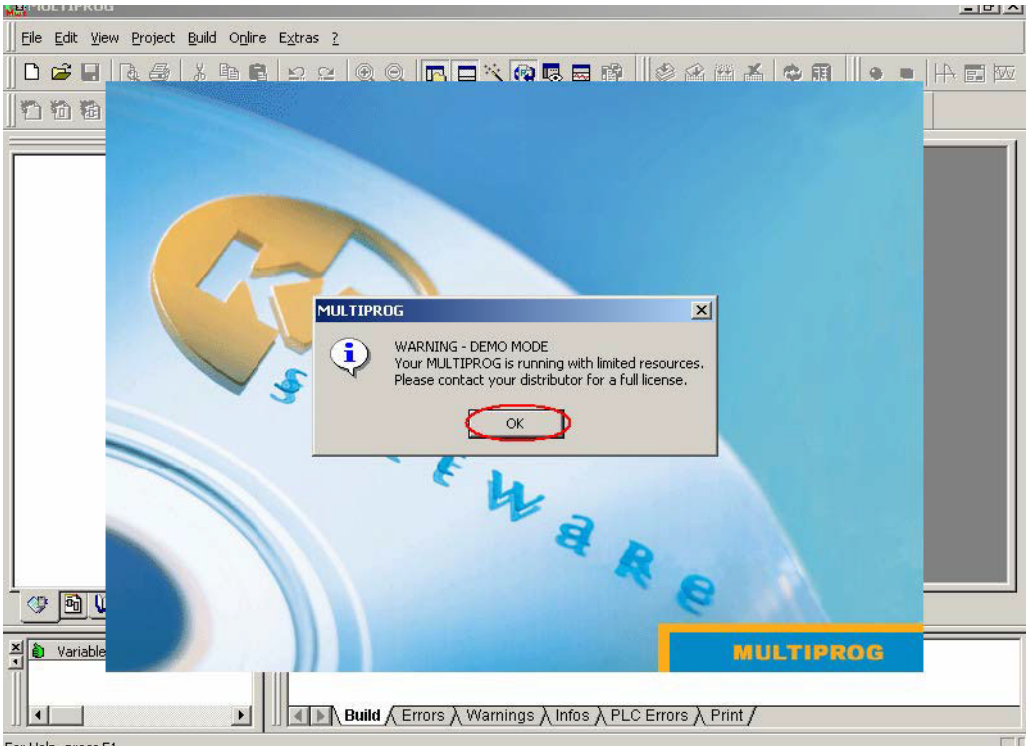
3.4 Create a Project and Test the System

In following demonstration, a simple project of performing DI and DO function by ladder diagram is shown. After finish this section, you can ensure the system is workable.

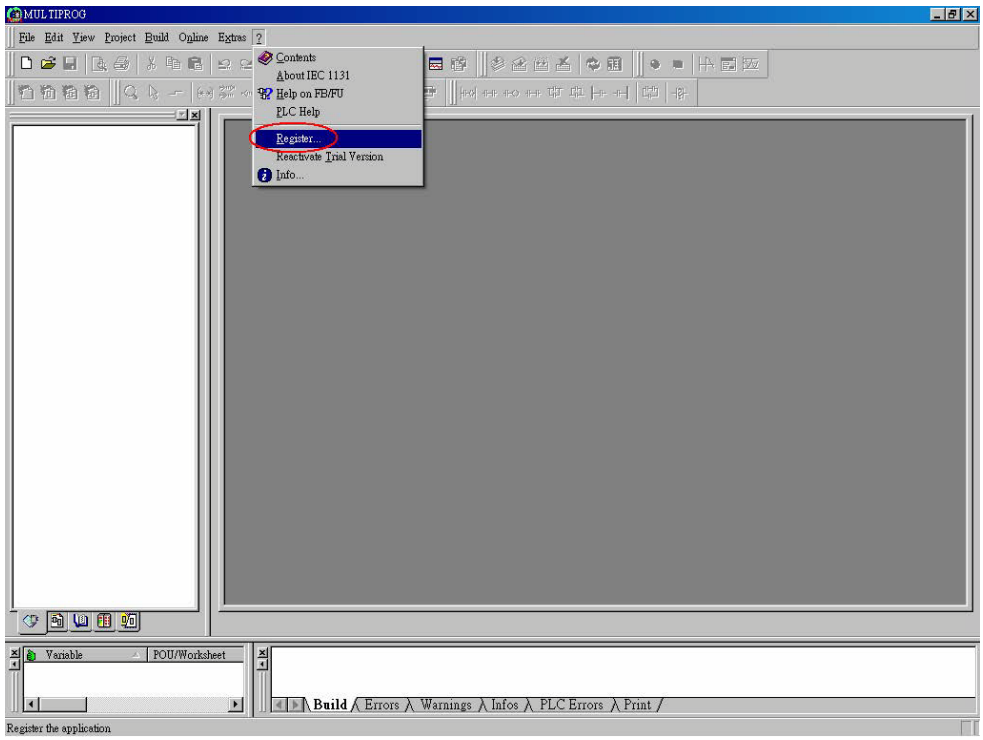
1. Open Advantech Multiprog by clicking Multiprog item.



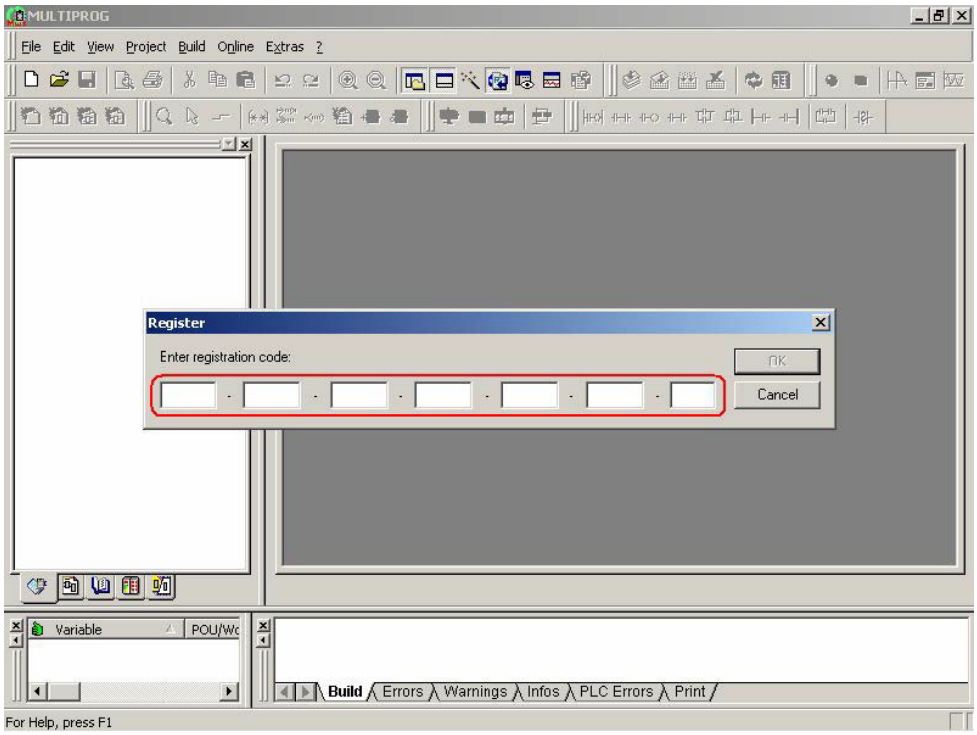
2. Click “OK” to enter the DEMO Mode.



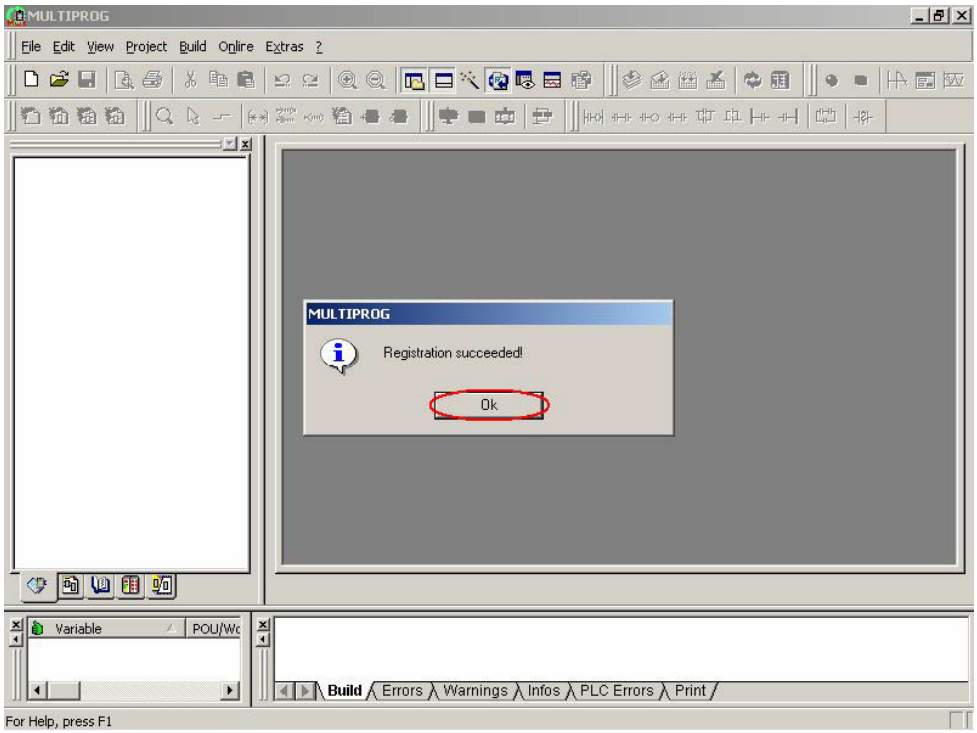
3. Click “Register” to enter the Registration Code.



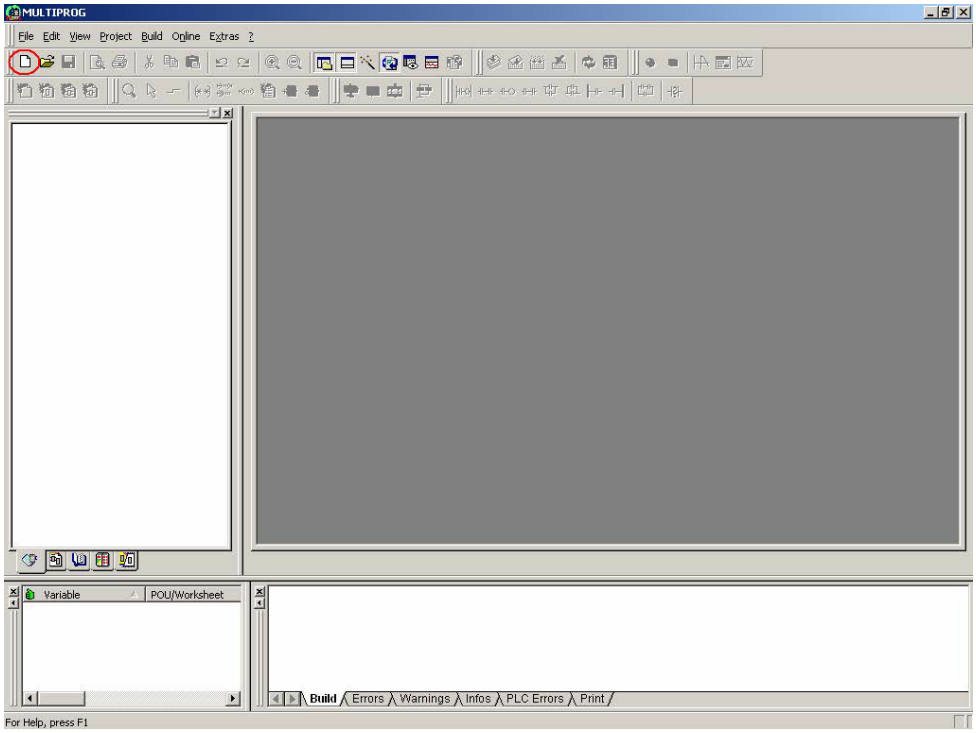
4. Enter the Registration Code which comes with Advantech Multiprog Software License Sheet.



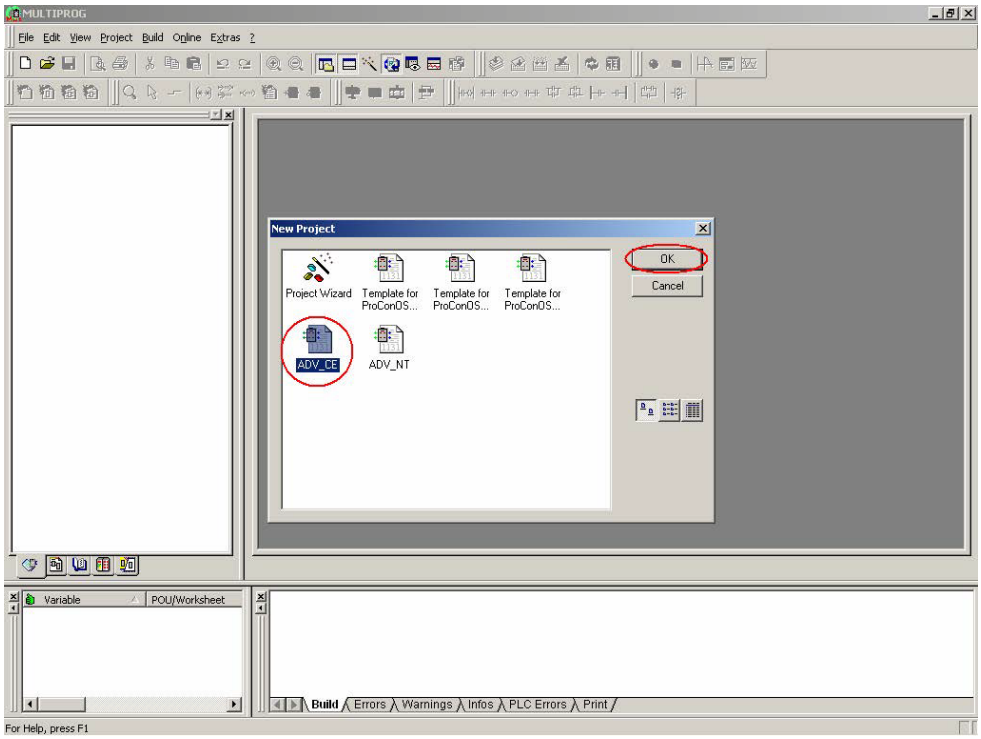
5. Click “OK” to finish the registration.



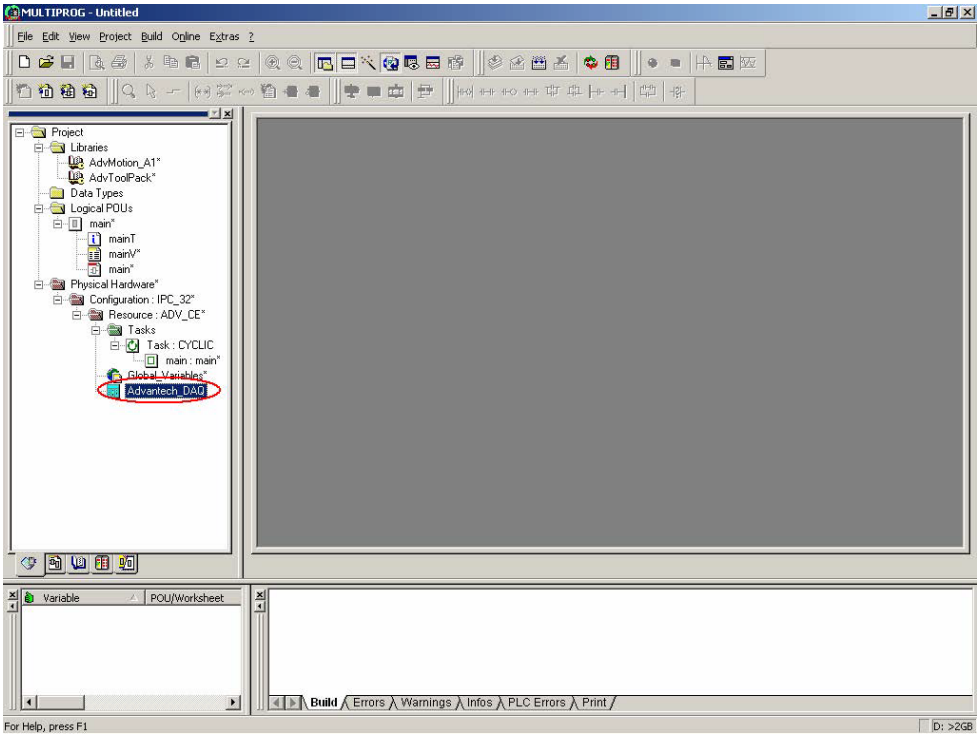
6. Open a new project and start to create the test project.



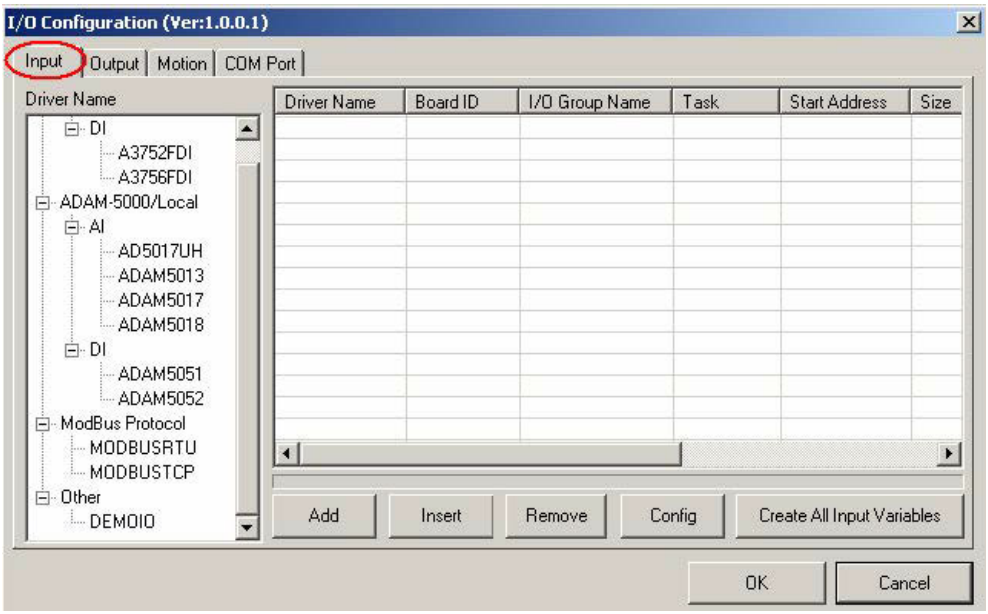
7. Select “ADAM-5560KW” item and then click “OK”.



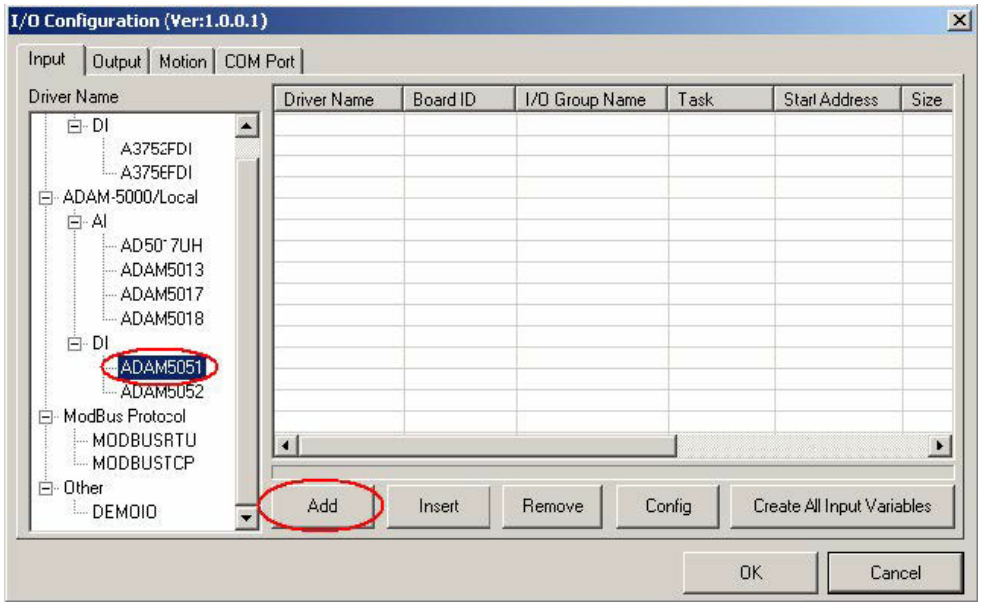
8. Double click “Advantech DAQ” item.



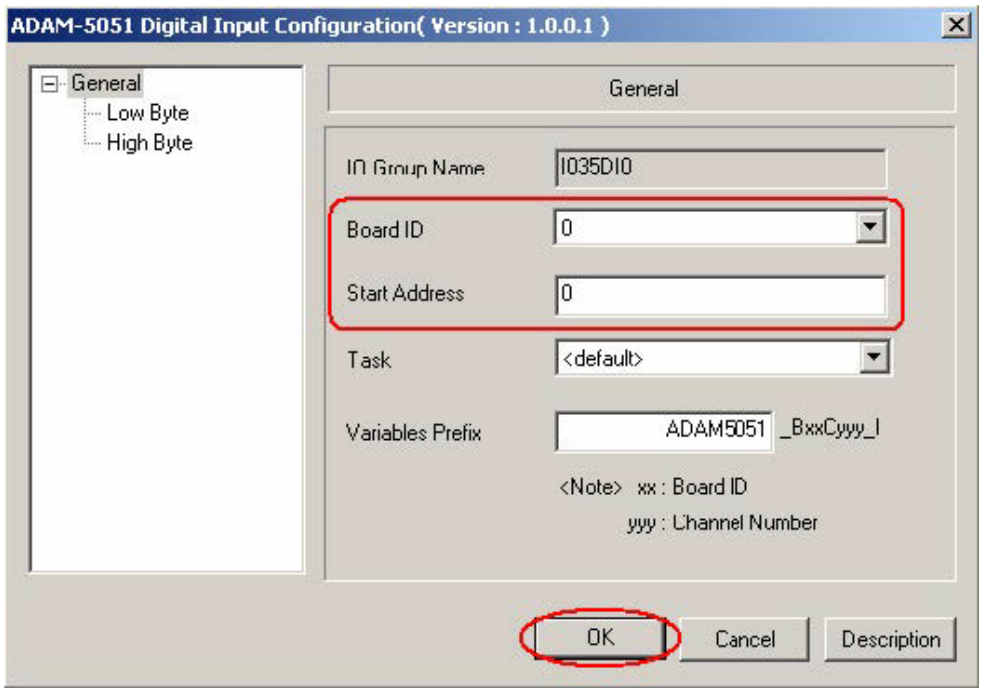
9. Check the folder is at “Input”.



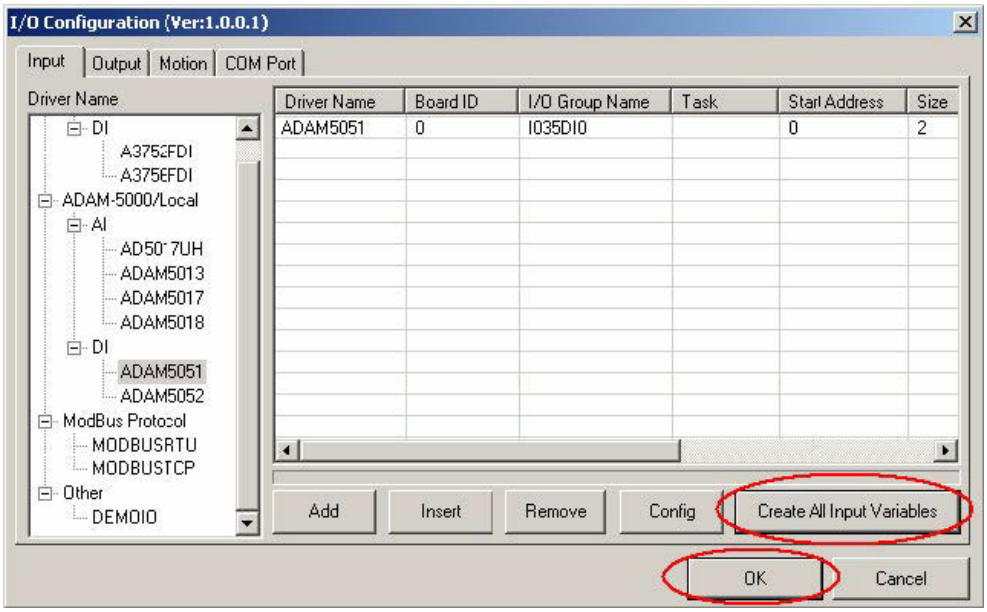
10. Select “ADAM5051” and then click “Add”.



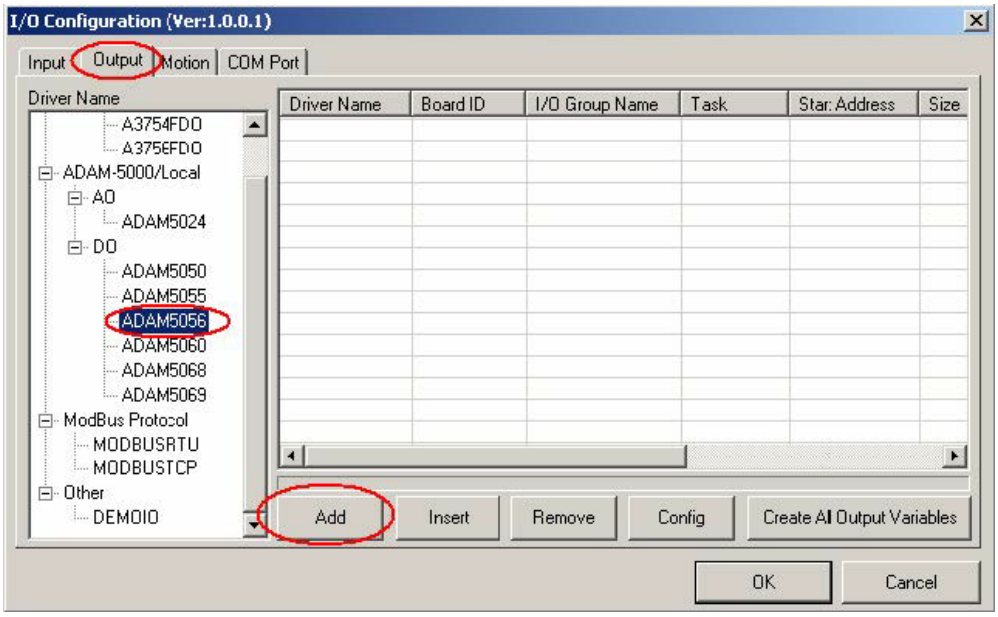
11. Select “0” for “Board ID”. Set “0” to “Start Address” and then click “OK”.



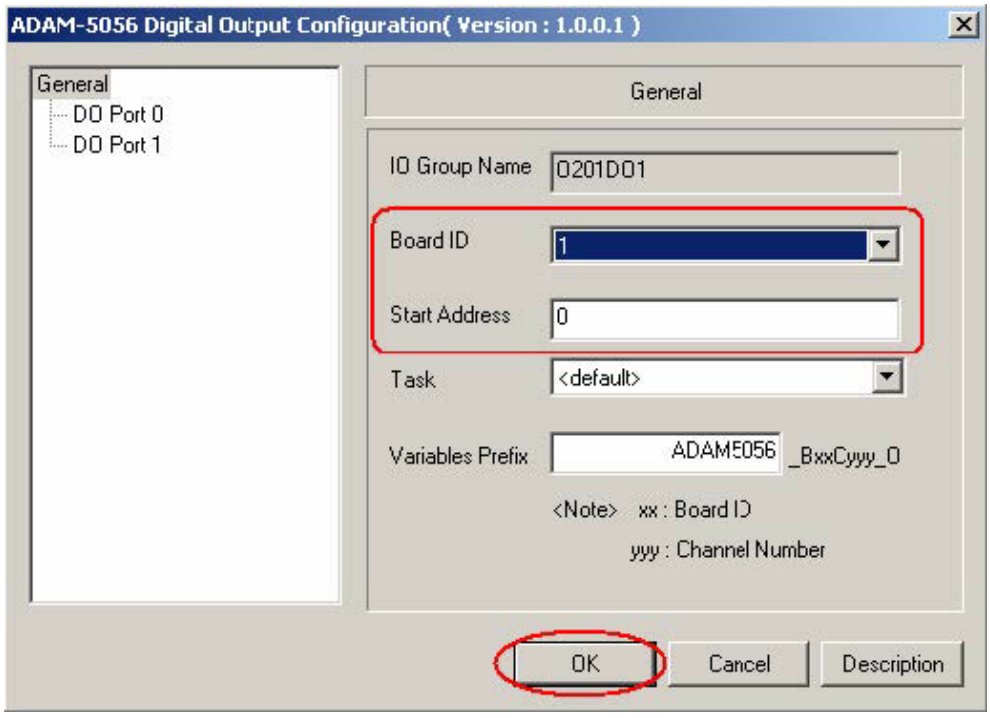
12. Click “Create All Input Variables” and then click “OK”.



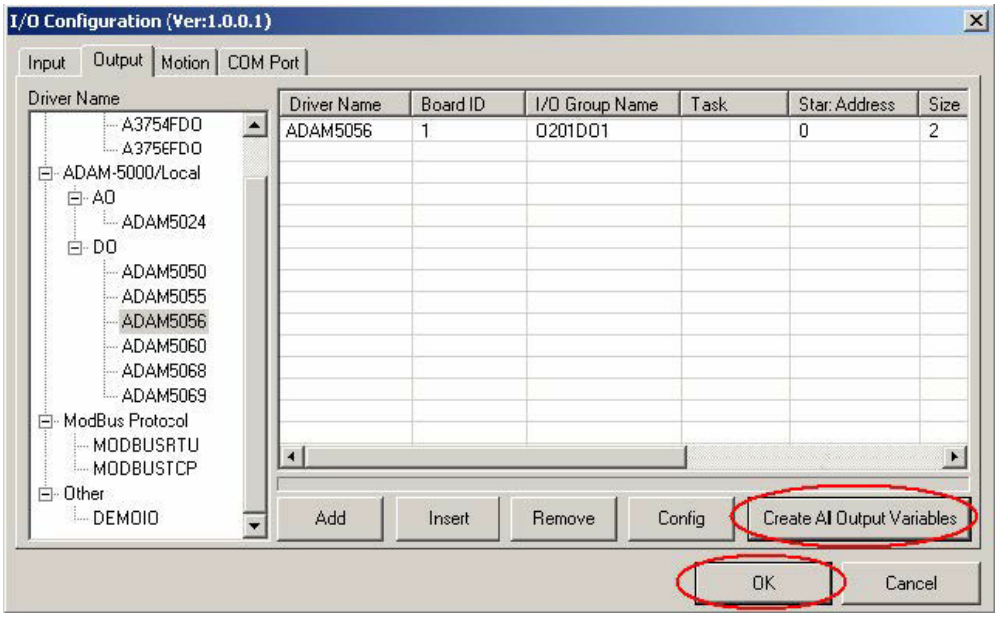
13. Click “Output” folder. Select “ADAM5056” and then click “Add”.



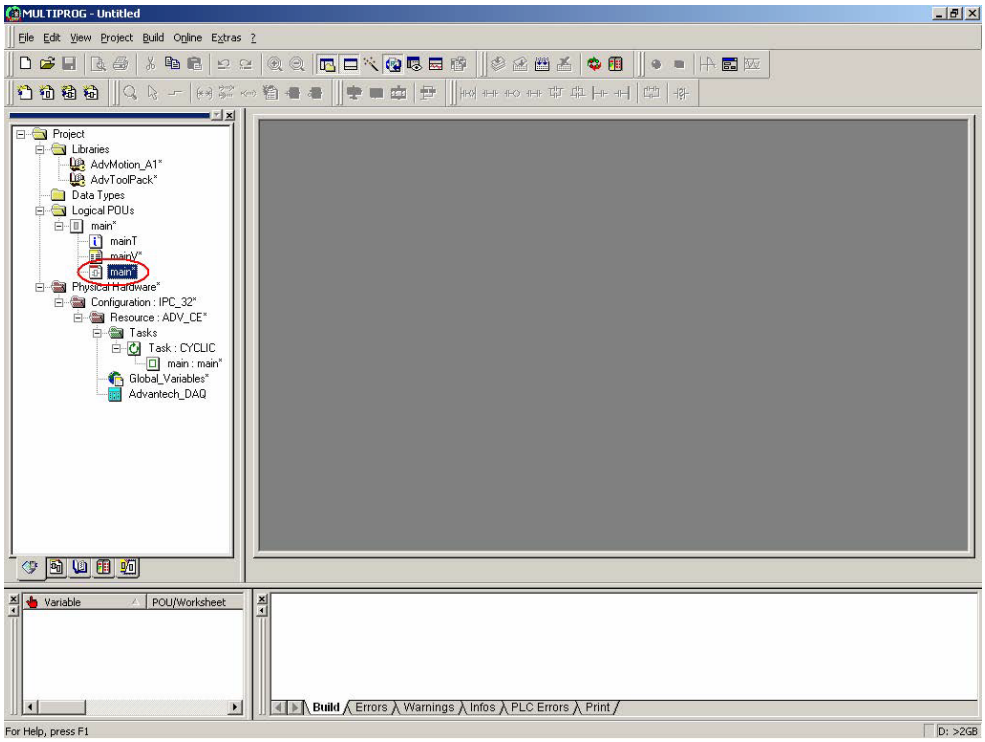
14. Select “1” for “Board ID”. Set “0” to “Start Address” and then click “OK”.



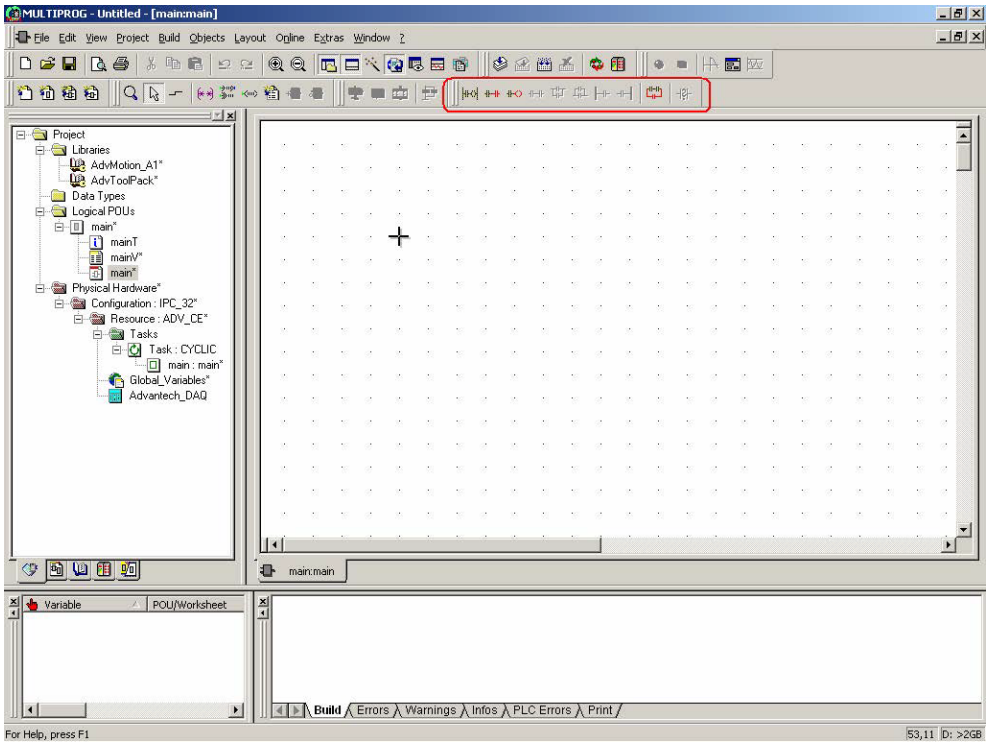
15. Click “Create All Input Variables” and then click “OK”.



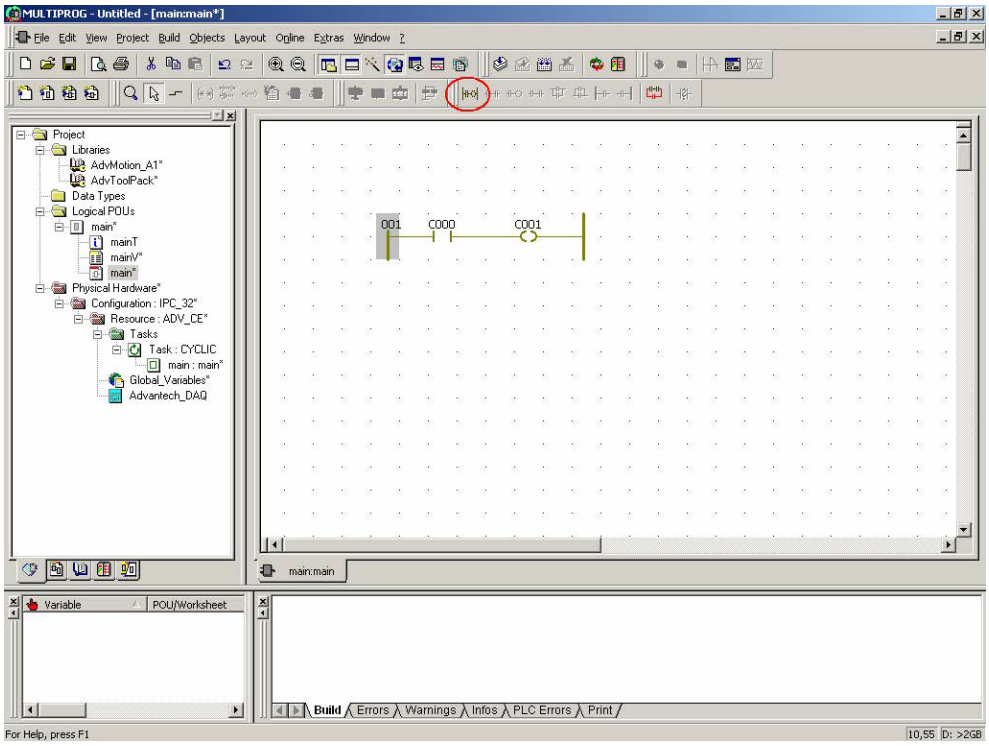
16. Double click “main” and graphical worksheet will be shown.



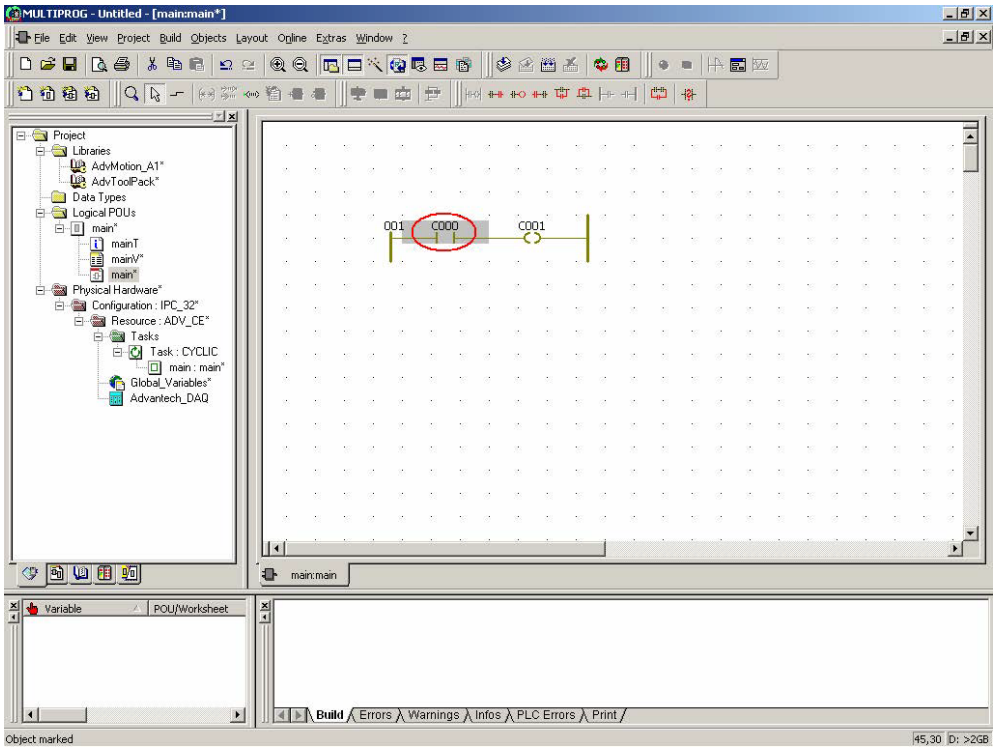
17. Click on the graphical editor and ladder objects will be activated.



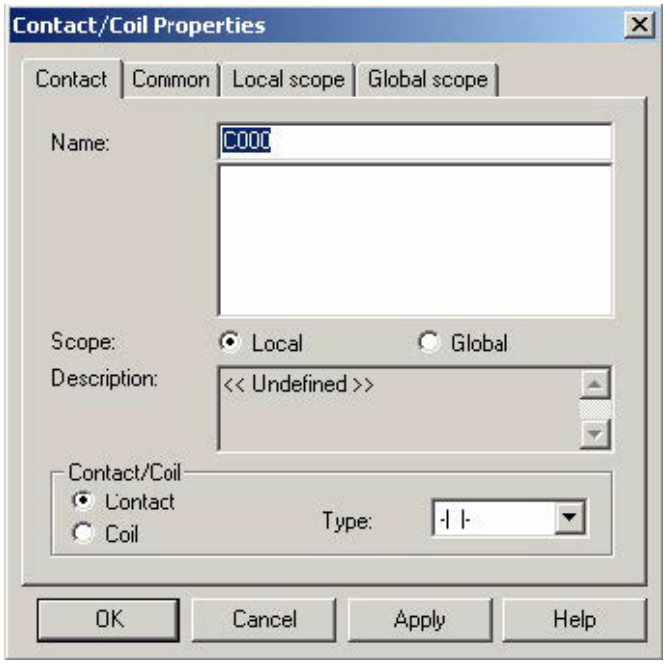
18. Add a contact network.



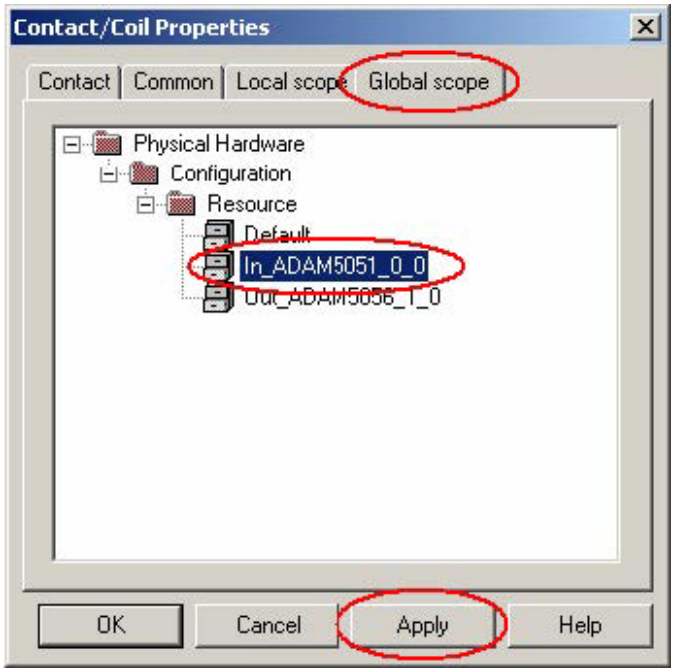
19. Double click “C000”.



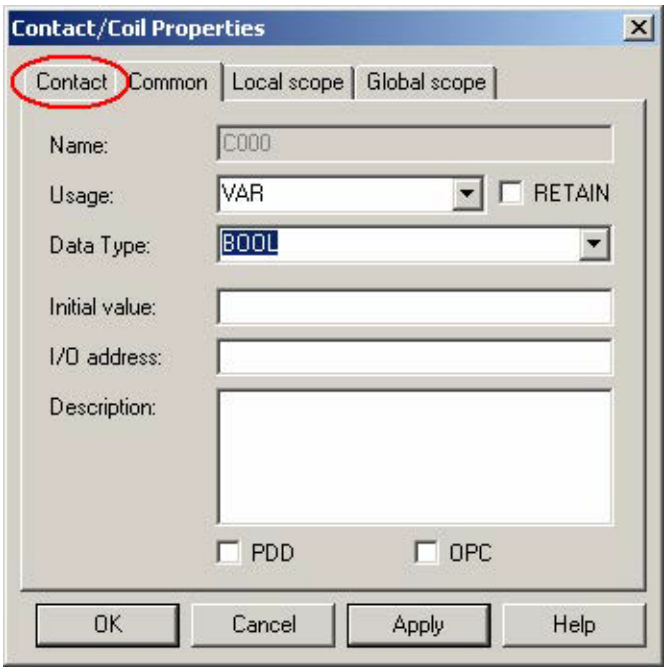
20. Dialog box of “Contact/Coil Property” will be shown.



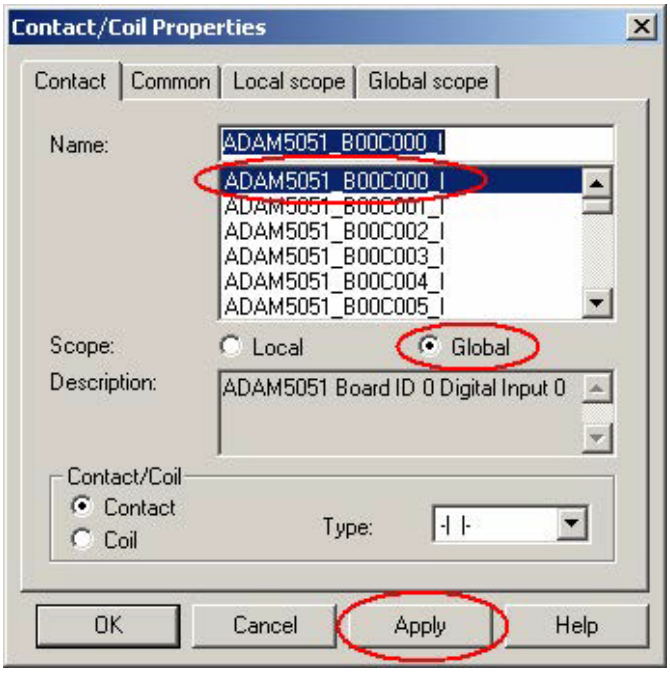
21. Click “Global scope”. Select “In_ADAM5051_0_0” and then click “Apply”.



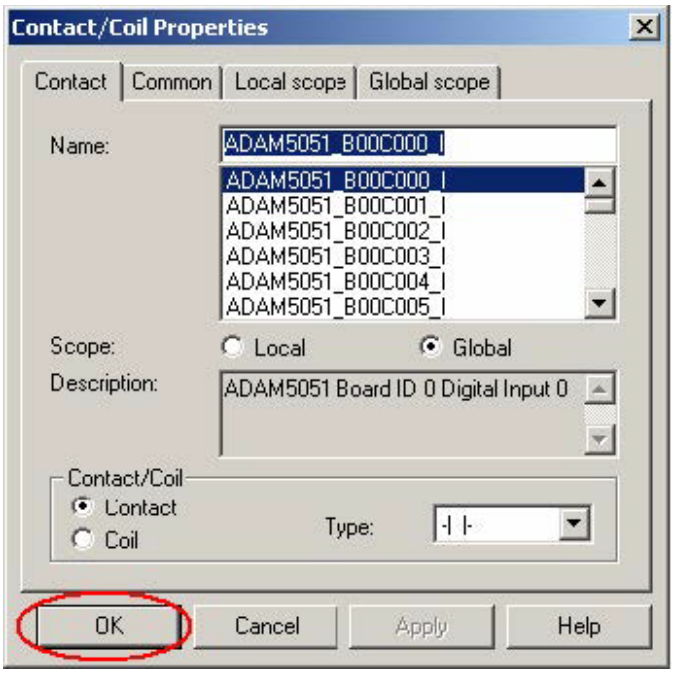
22. “Common” folder will be shown. Click “Contact” folder.



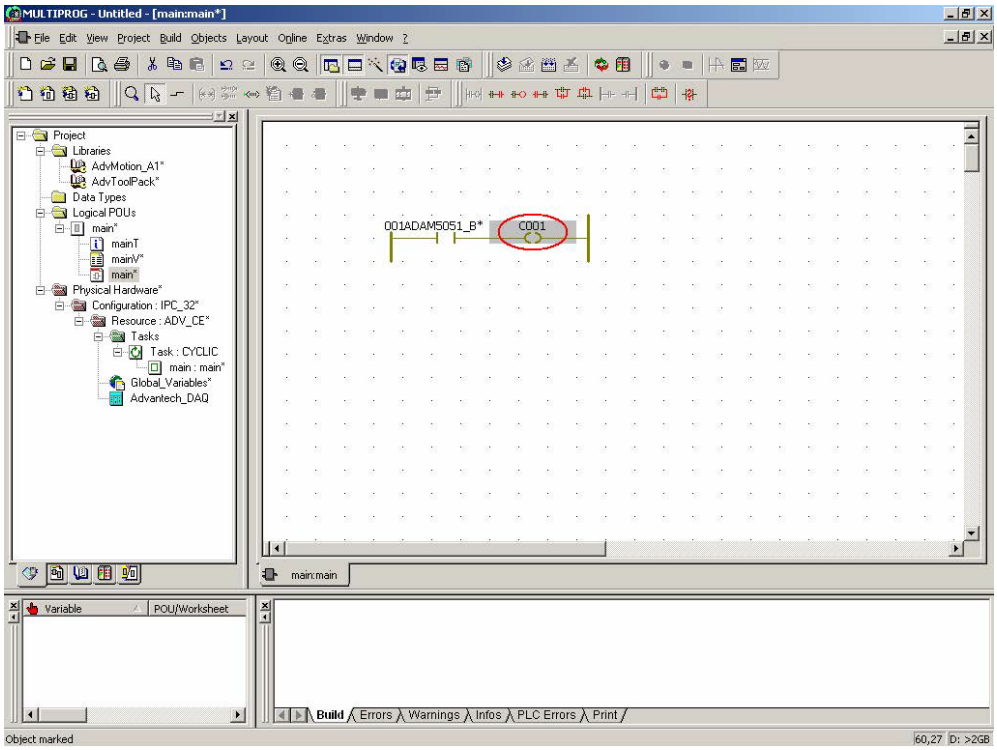
23. Click “Global”. Select “ADAM5051_B00C000_I” and then click “Apply”.



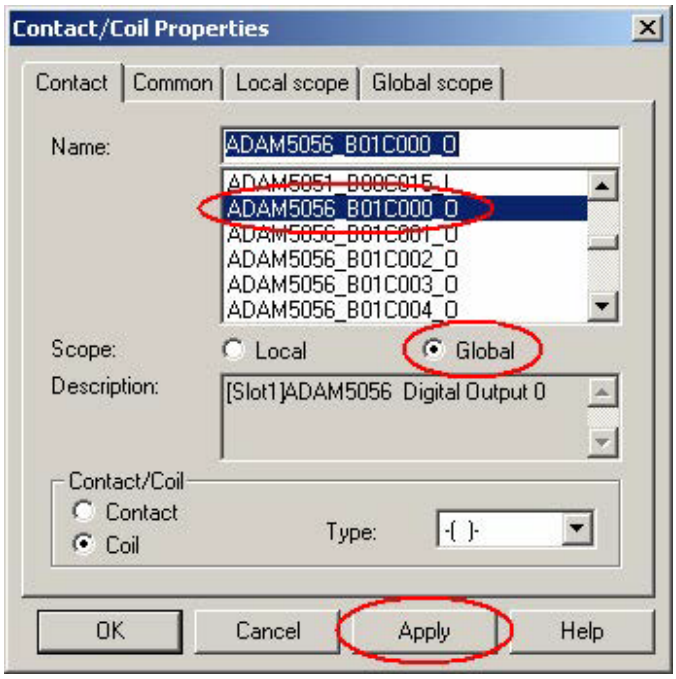
24. Click “OK”.



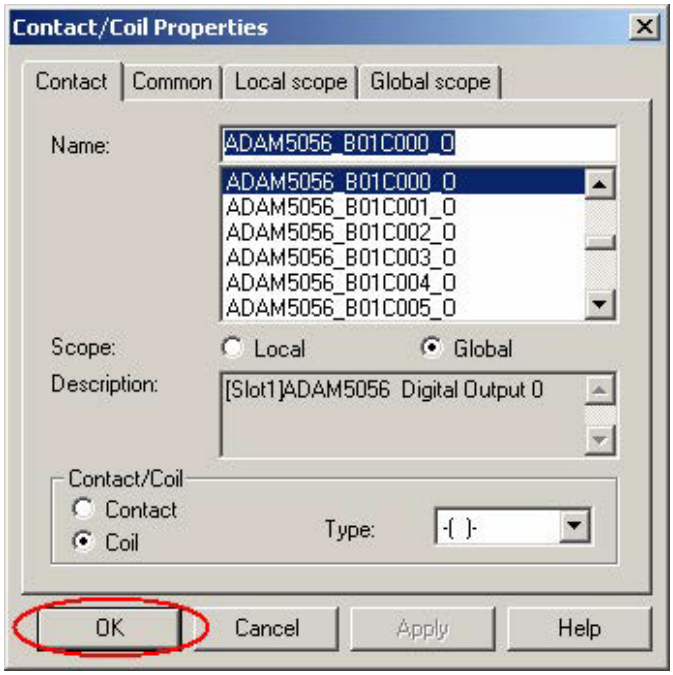
25. Double click “C001”.



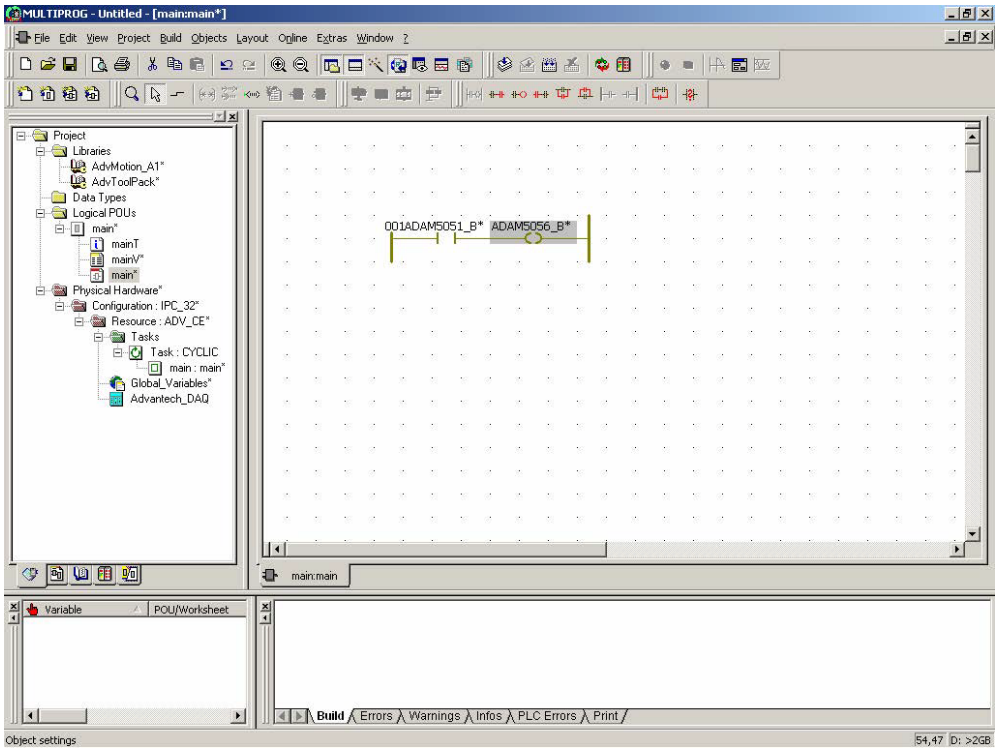
26. Click “Global”. Select “ADAM5056_B01C000_O” and then click “Apply”.



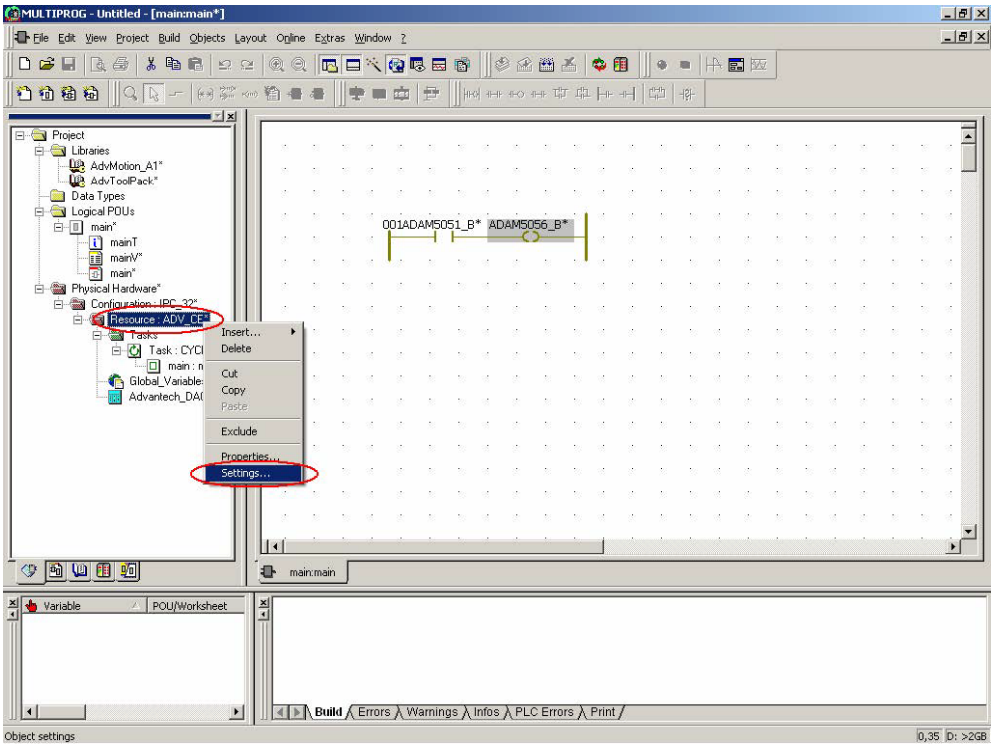
27. Click “OK”.



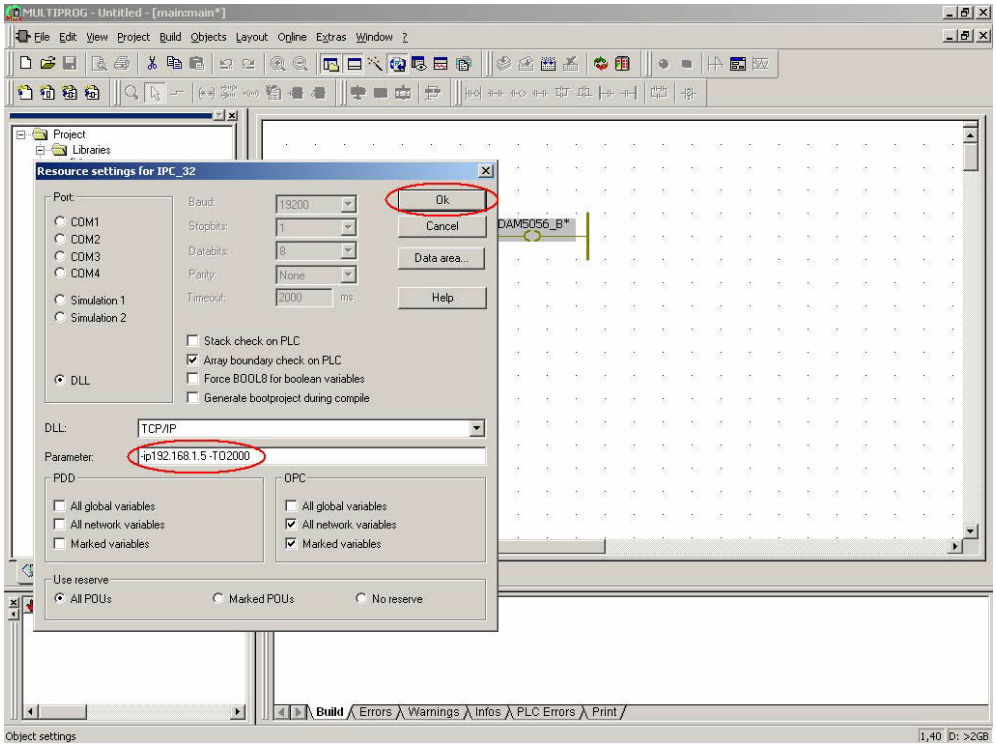
28. Back to graphical editor.



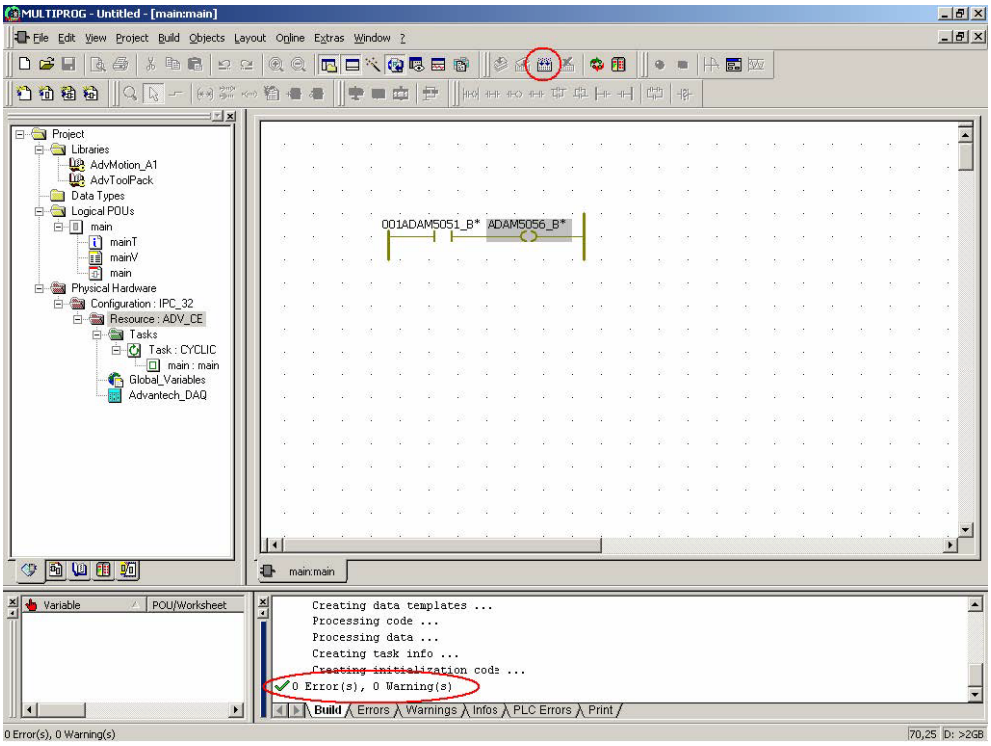
29. Right click “Resource: ADV_CE” and then click “Settings”.



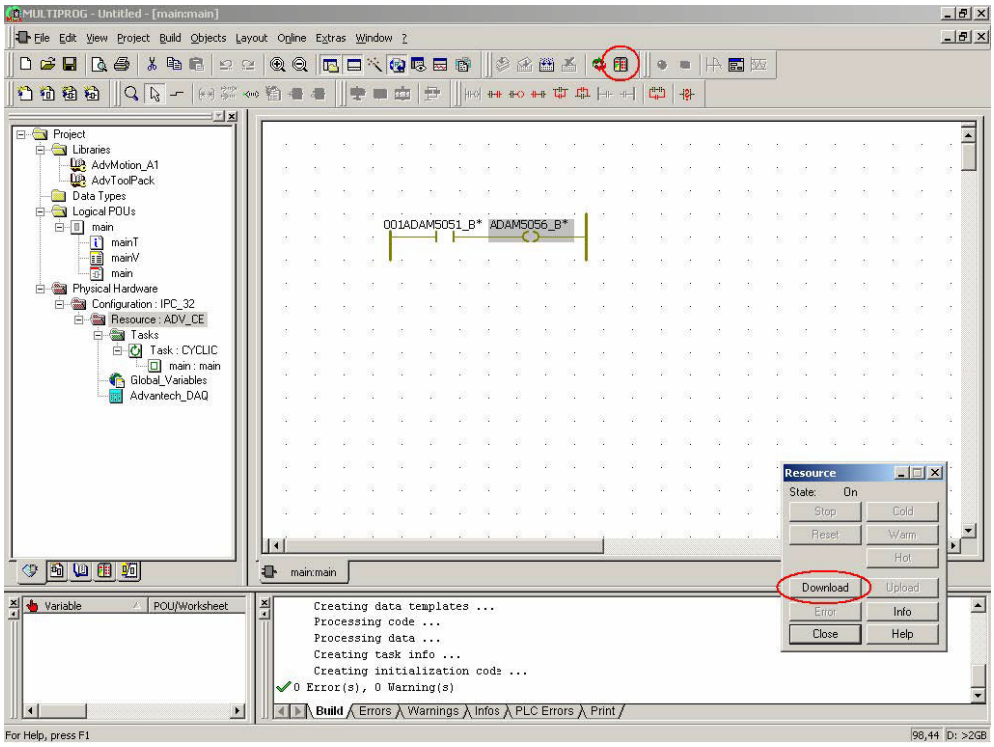
30. Type IP Address of ADAM-5560KW as “192.168.1.5”.



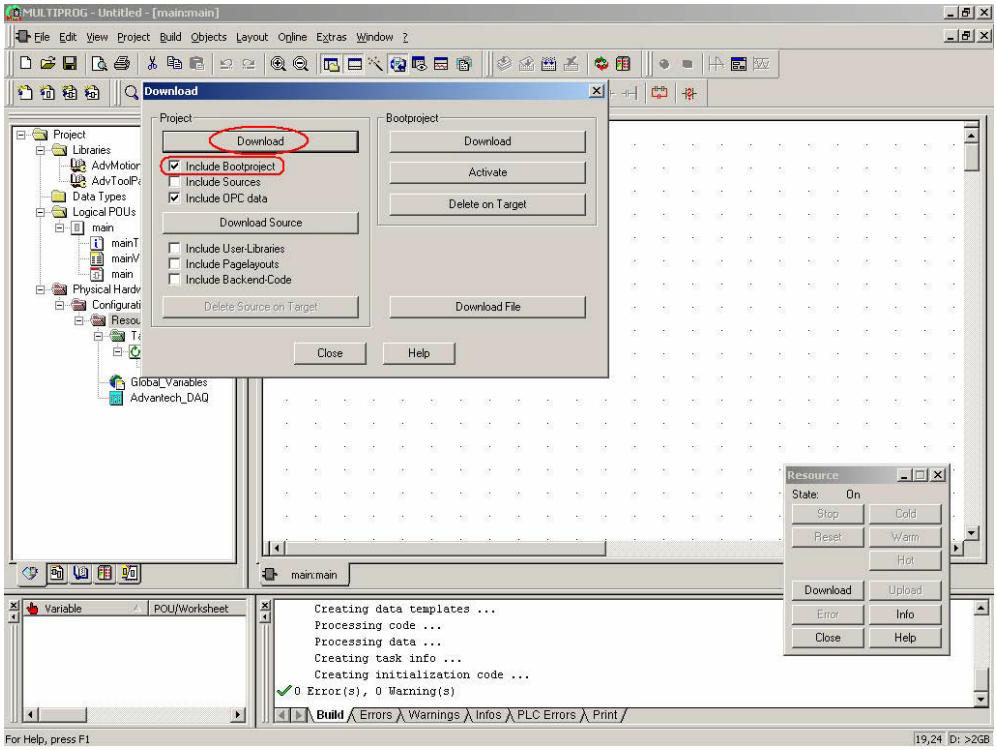
31. Click “Make” to build the execution file. Check the project has been compiled successfully.



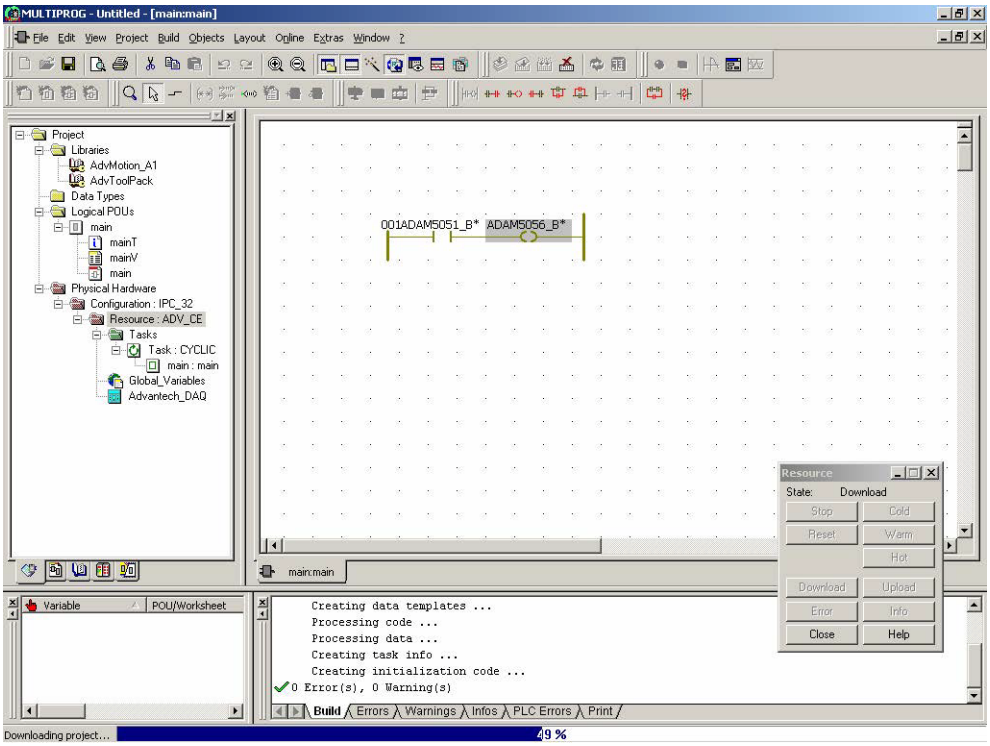
32. Click “Project Control Dialog” and then click “Download”.



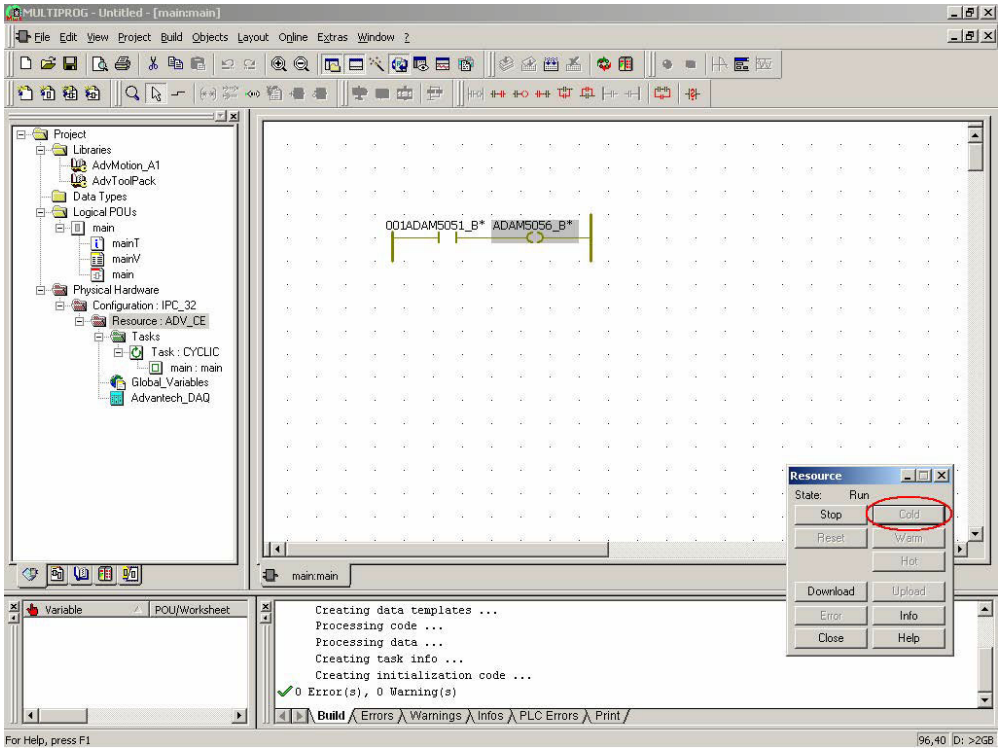
33. Check “Include boot project” and then click “Download”.



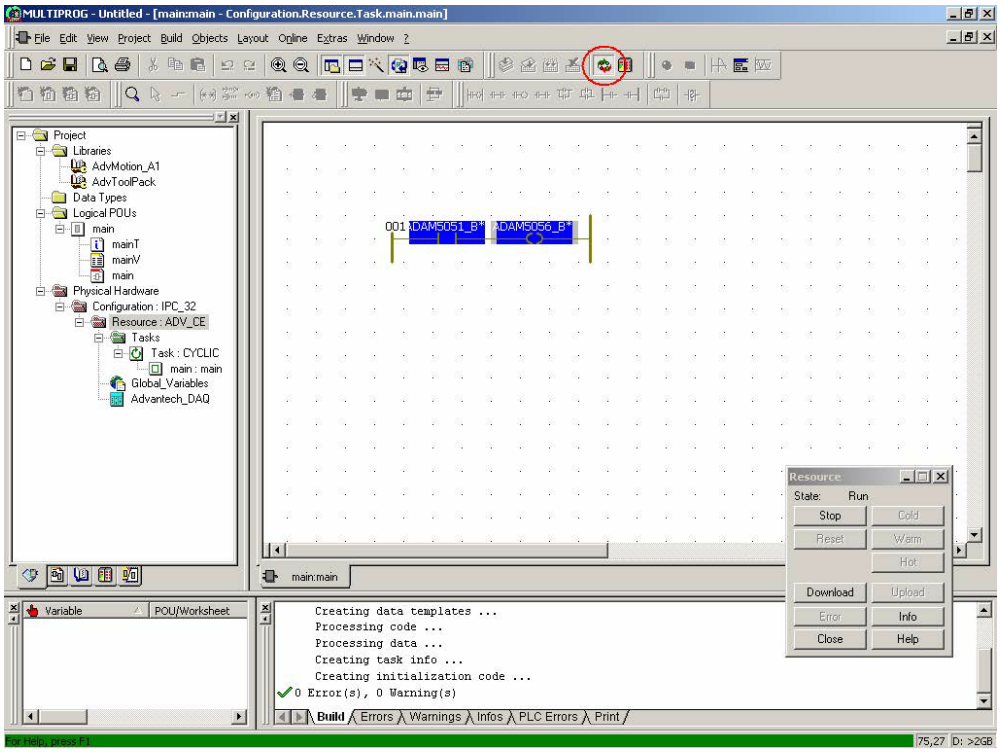
34. Downloading execution file to ADAM-5560KW.



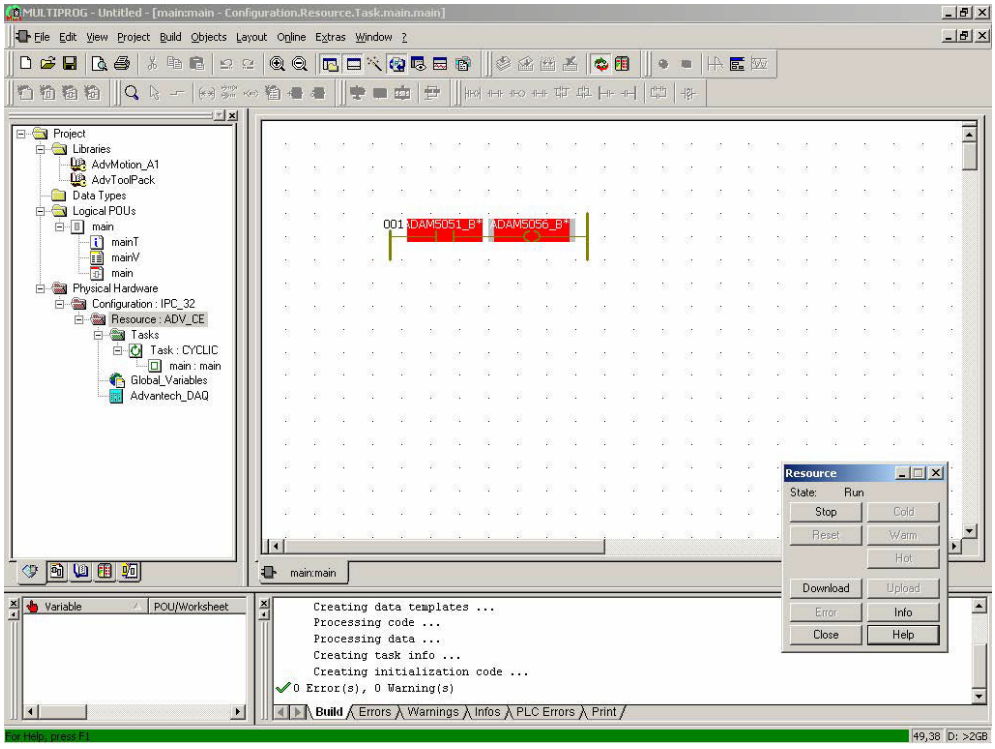
35. Click “Cold” to execute a cold start. During a cold start all data are initialized.



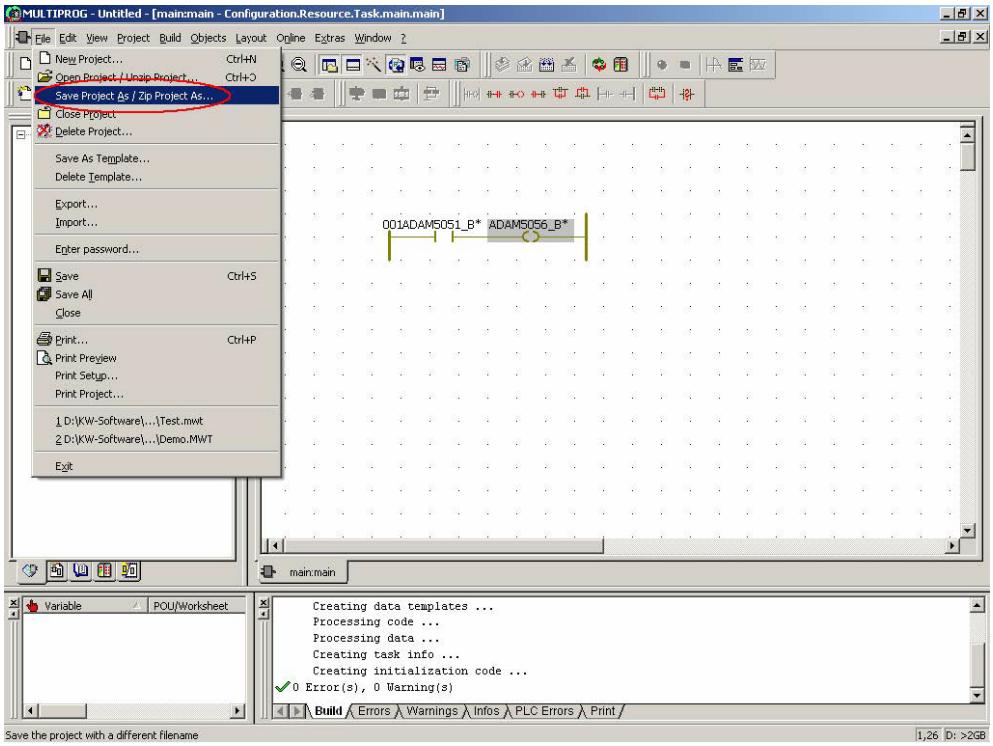
36. Click “Debug On/Off” to turn on the debug function. The ADAM-5560KW is running correctly when you see the status bar turns green color. You can see the DI0 and DO0 are turned blue color. It means the state is FALSE.



37. When you change the state of ADAM-5051D CH0 as ON, ADAM-5056 CH0 turns ON correctly. The DI0 and DO0 on graphical editor are turned red color too. It means the state is TRUE.



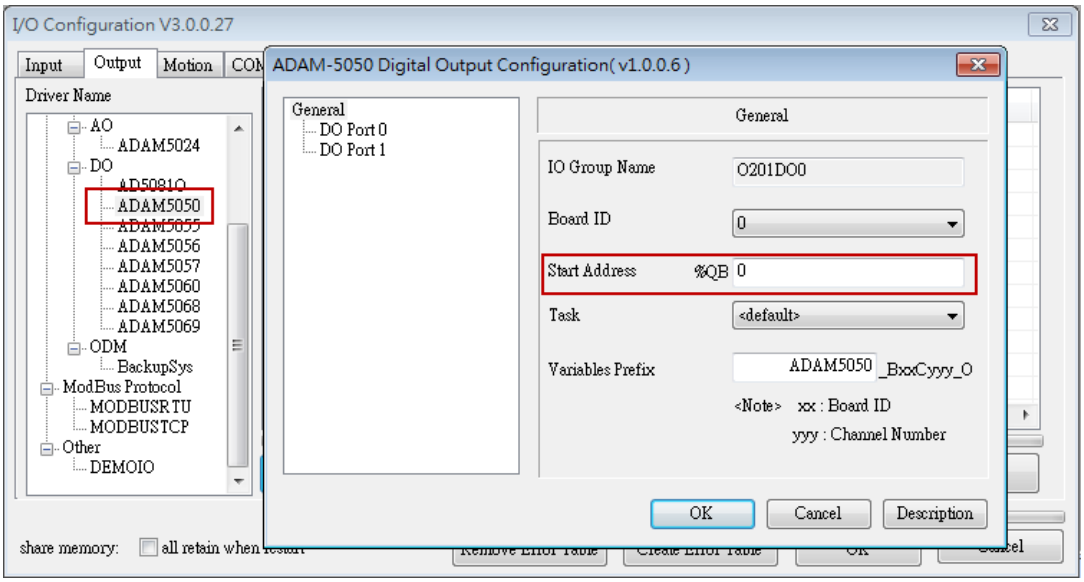
38. Finish the test project and do not forget to save it properly.



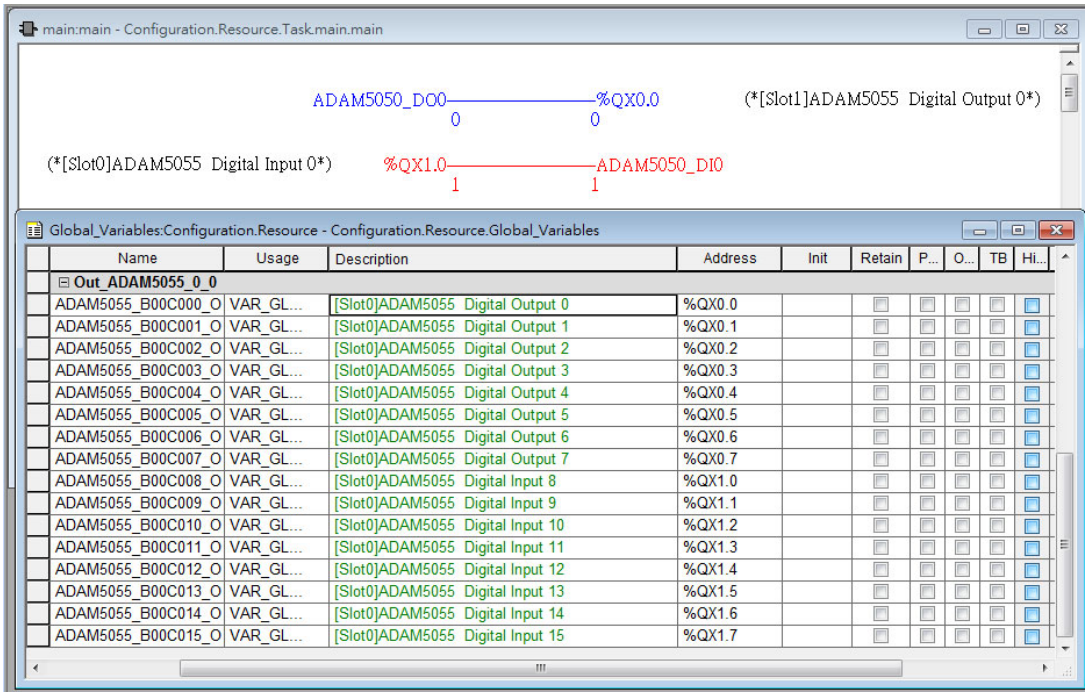
3.5 Special Module Support in KW

ADAM-5050 is one of mix digital input/output module and each channel can be independently configured to be an input or an output channel by the setting of its DIP switch (Please refer the user manual of ADAM-5000 IO Module to get more detail).

For the ADAM-5050 configuration in MultiProg KW, we define it as an output module only. The IO address will show as %QX by channel.



In program, you still can read the status of the output as the input signal that you define it as an input by hardware DIP switch.



Chapter 4

Modbus Functions

4.1 Introduction

The Modbus functions of ADAM-5560KW Controller are powerful features which provide high expansibility and flexibility for user's applications. The supported modbus functions include following items.

- Modbus/RTU Master Function: Connect to Modbus/RTU remote I/O modules such as Modbus modules of ADAM-4000 series.
- Modbus/TCP Client Function: Connect to Modbus/TCP remote I/O modules such as ADAM-6000 series.
- Modbus/TCP Server Function: Connect to HMI/SCADA software via Ethernet port.

4.2 Modbus/TCP Client Function

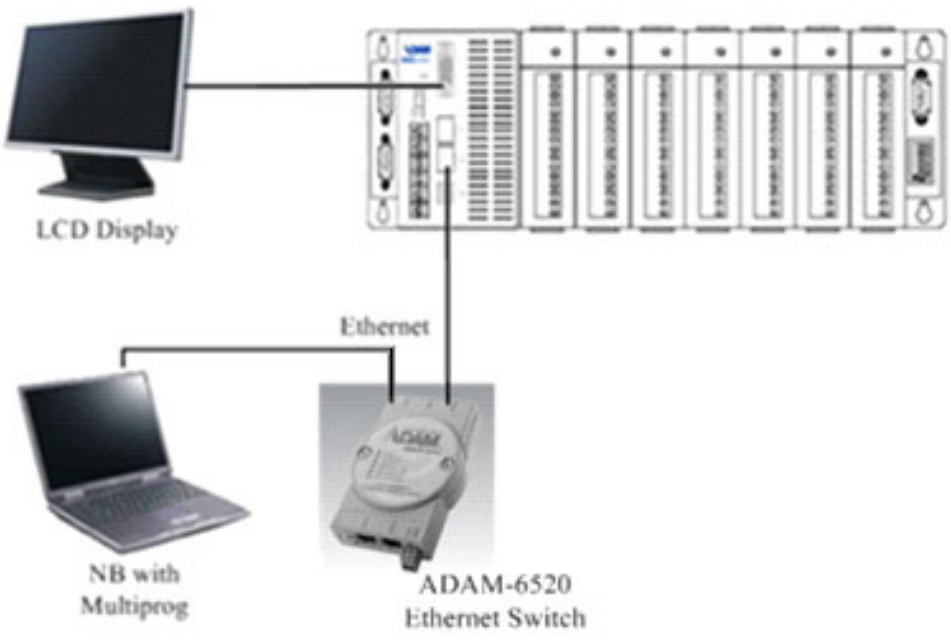
The Modbus/TCP client function can connect to Modbus devices with Modbus/TCP server function, for example, ADAM-5560/TCP and ADAM-6000 series I/O modules.

Following example can show how to connect to ADAM-6050 by Modbus/TCP client function.

ADAM-6050 settings:
IP address: 192.168.1.12

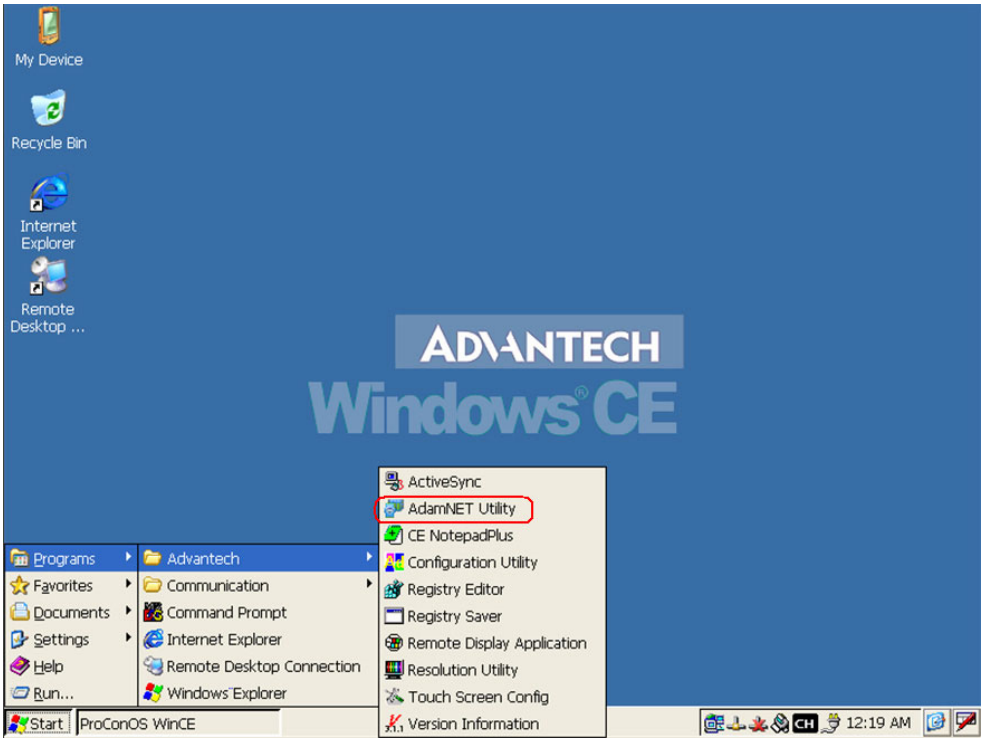
ADAM-5560 Series Controller settings:
Slot 0: ADAM-5051D
Slot 1: ADAM-5056D
IP address: 192.168.1.5

System Wiring:

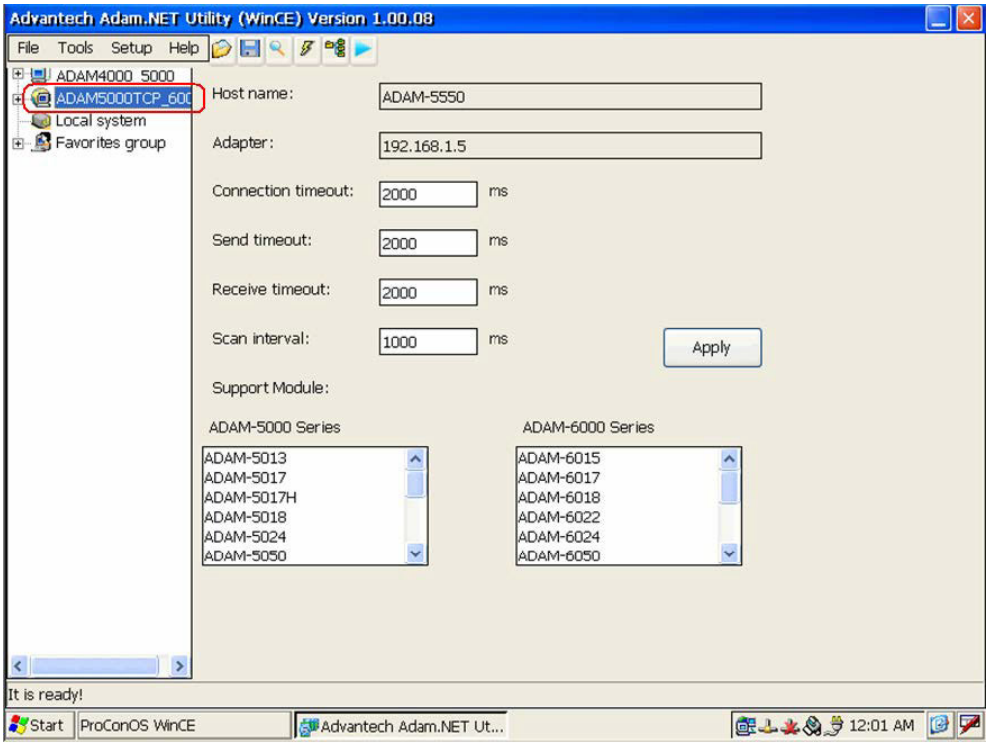


4.2.1 An example to demonstrate how to connect to ADAM-6050 for Modbus/TCP client function

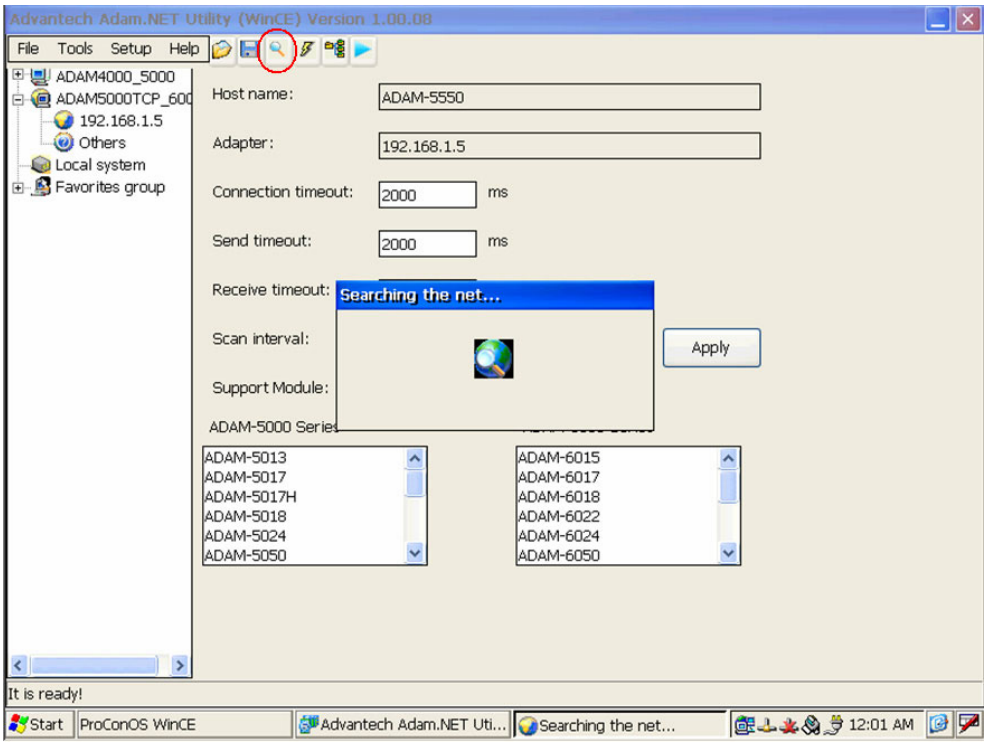
1. ***[PAC Device]*** Run ADAM.NET utility by clicking “Start” -> “Programs” -> “Advantech” -> AdamNET Utility.



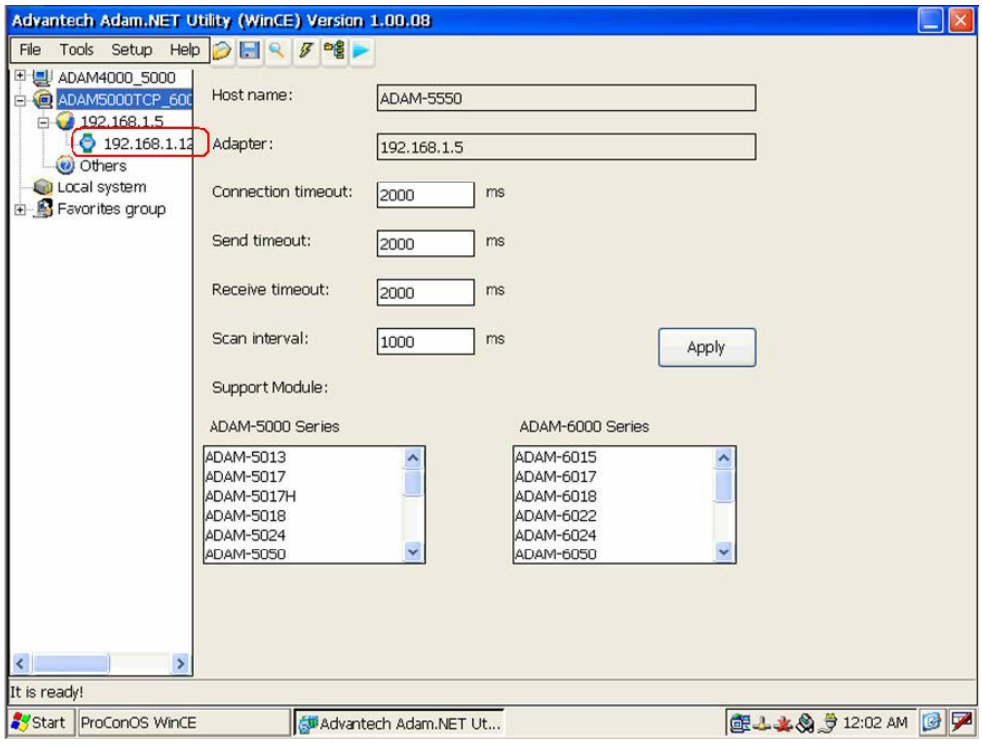
2. ***[PAC Device]*** Select “ADAM5000TCP_6000” item.



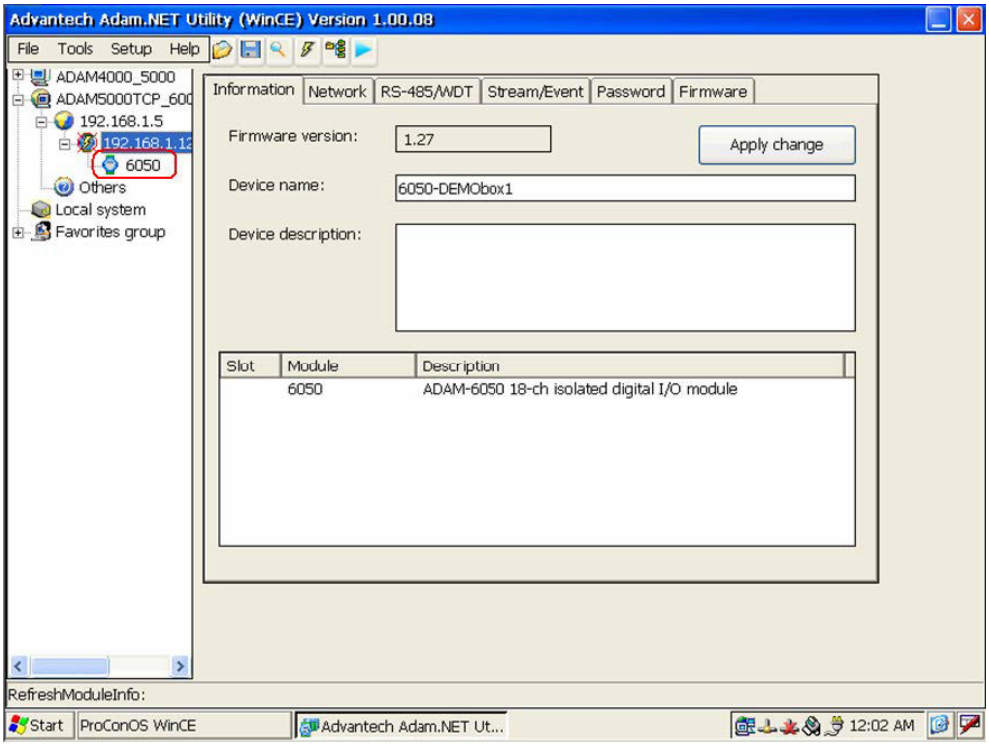
3. ***[PAC Device]*** Click “Search” button.



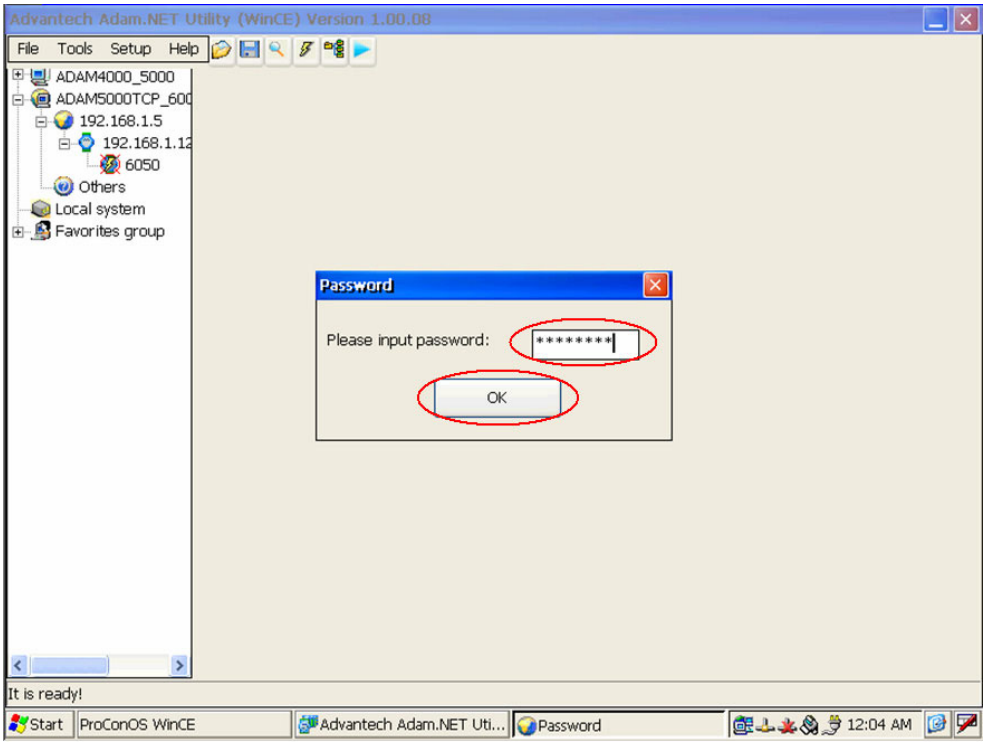
4. ***[PAC Device]*** Click “192.168.1.12” item and then “6050” item will show.



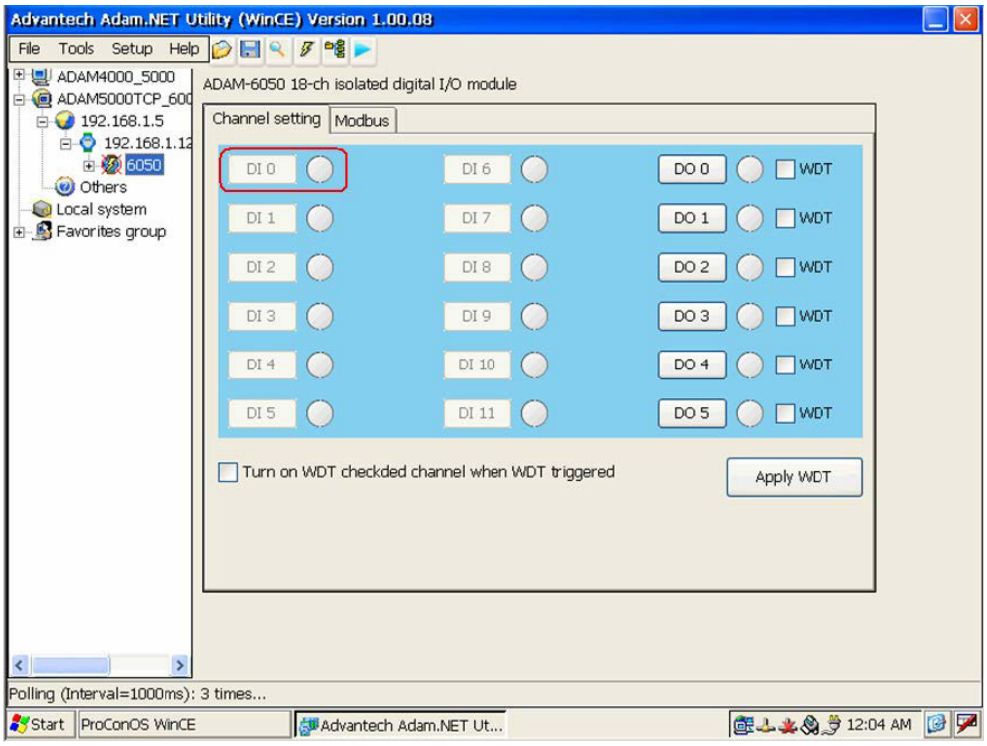
5. ***[PAC Device]*** Click “6050” item to see the channel setting.



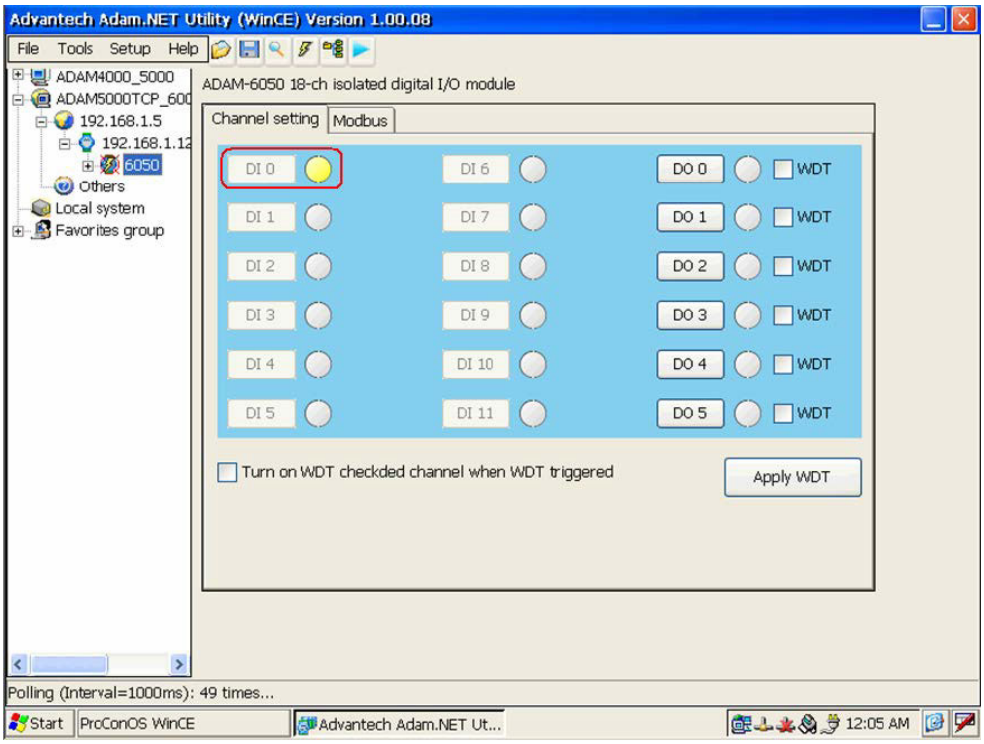
6. ***[PAC Device]*** Enter “00000000” and then click “OK” button.



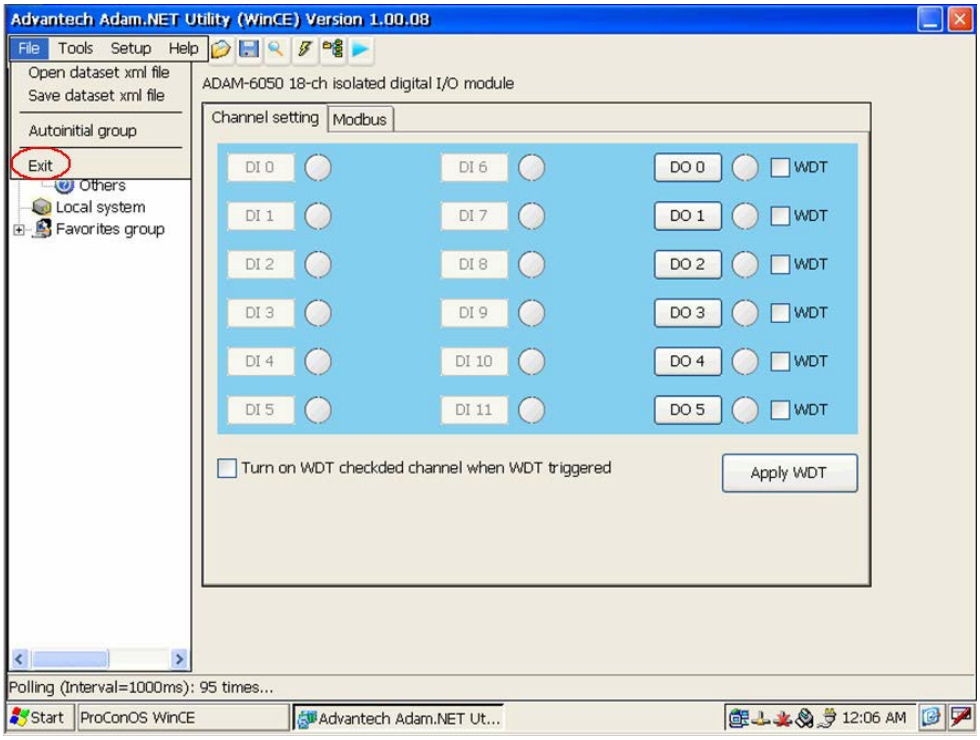
7. ***[PAC Device]*** Check ADAM-6050 DI bit 0 is OFF.



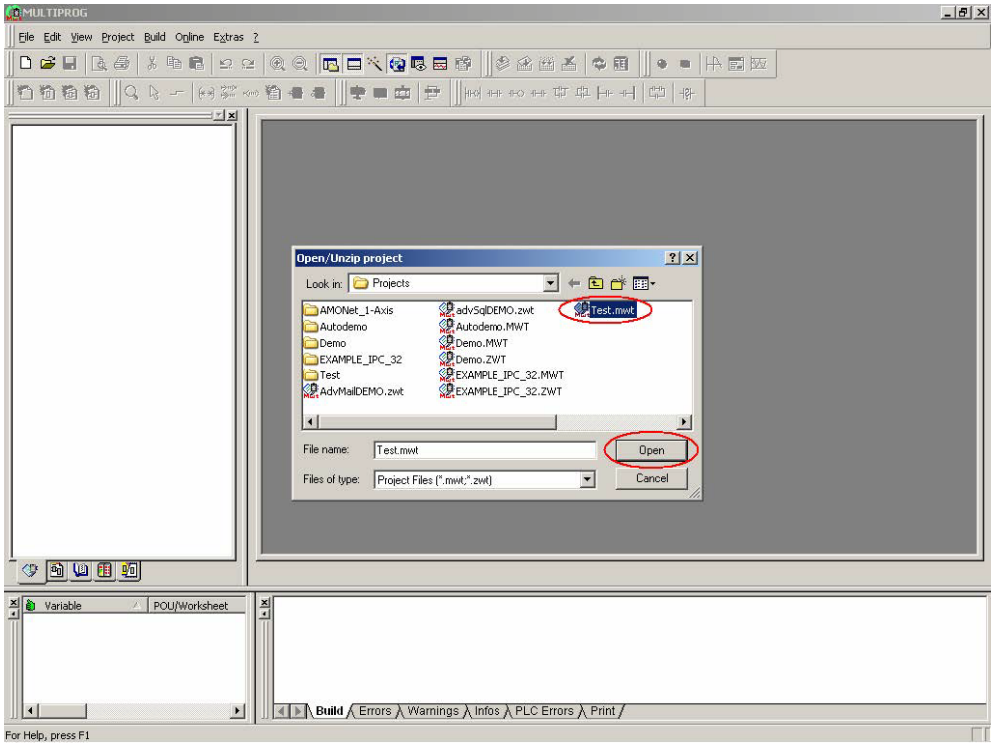
8. ***[PAC Device]*** Turn on ADAM-6050 DI bit 0 and make sure the status is ON in the utility.



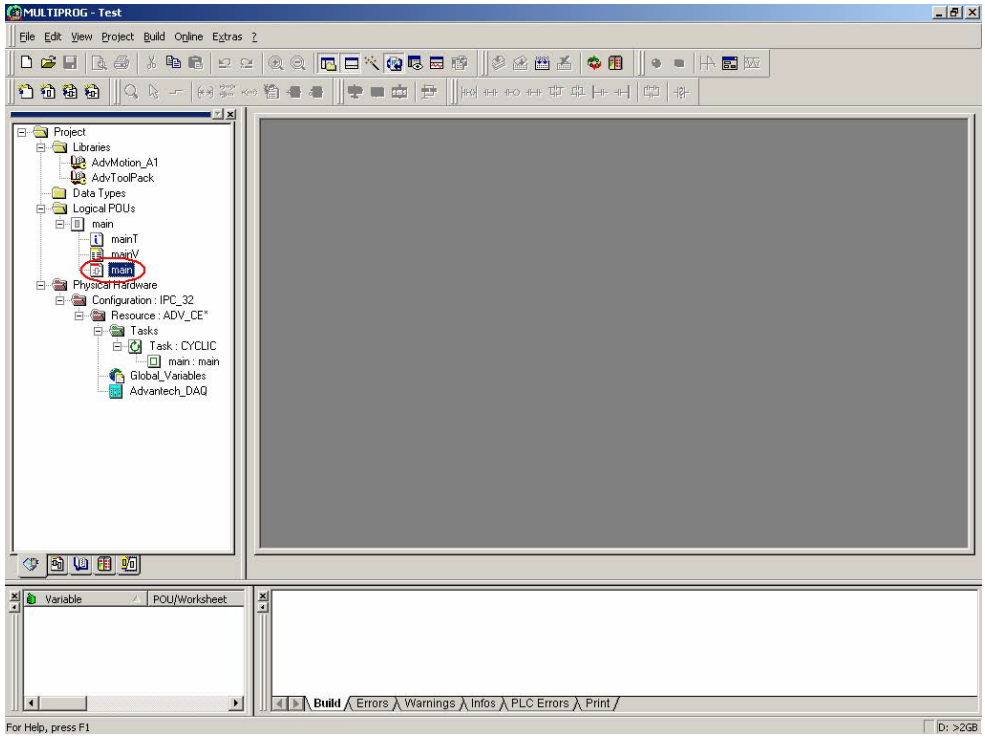
9. ***[PAC Device]*** ADAM-6050 setting is correct. Exit from the ADAM.NET utility.



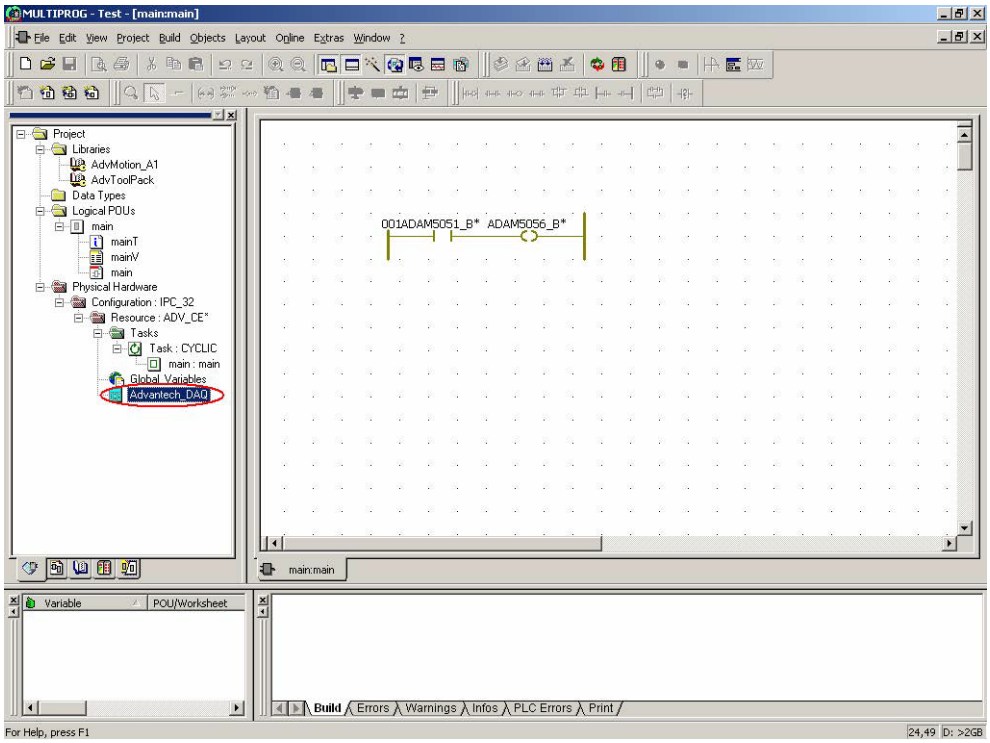
10. Open “Test.mwt” and follow the example in section 3.4.



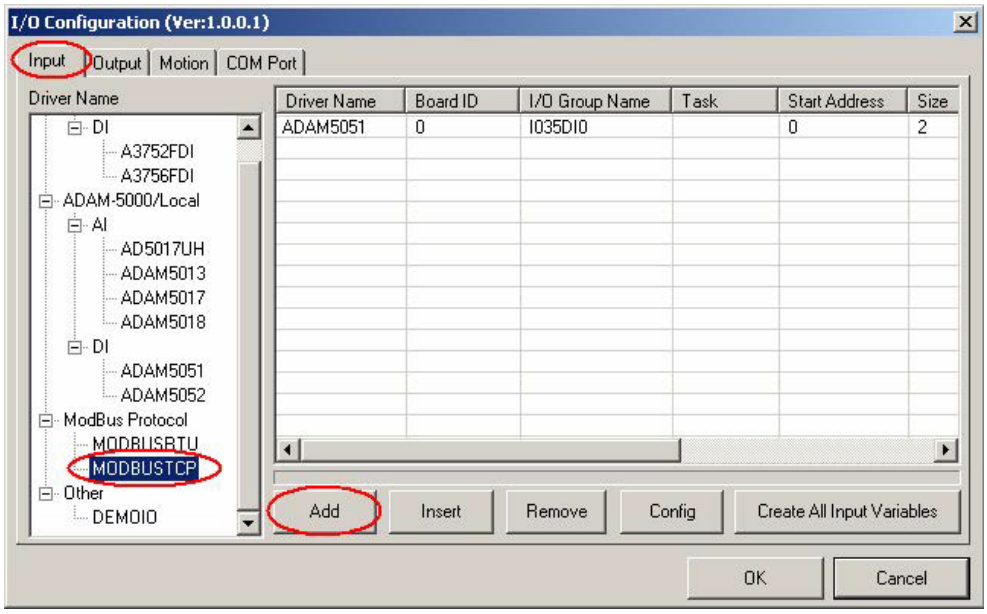
11. Double-click “main” to show the program in graphical editor.



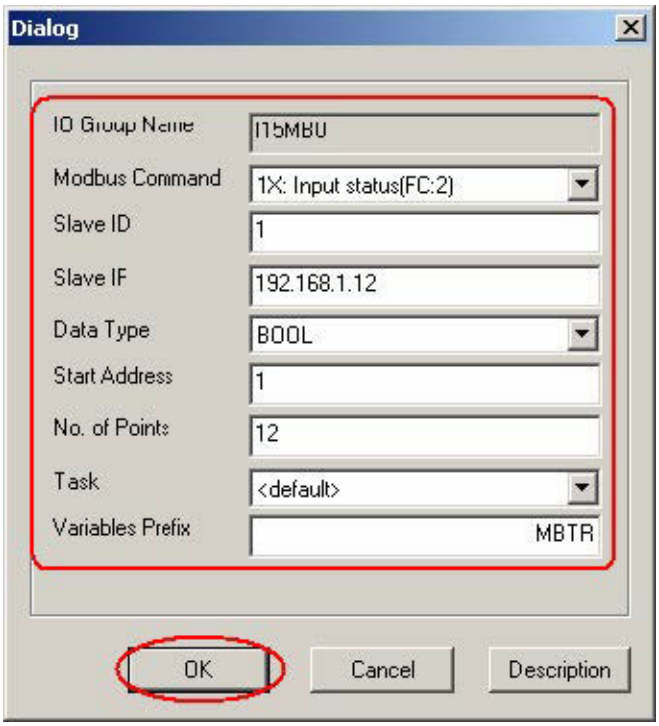
12. Double-click “Advantech_DAQ” to show the “I/O Configuration” dialog box.



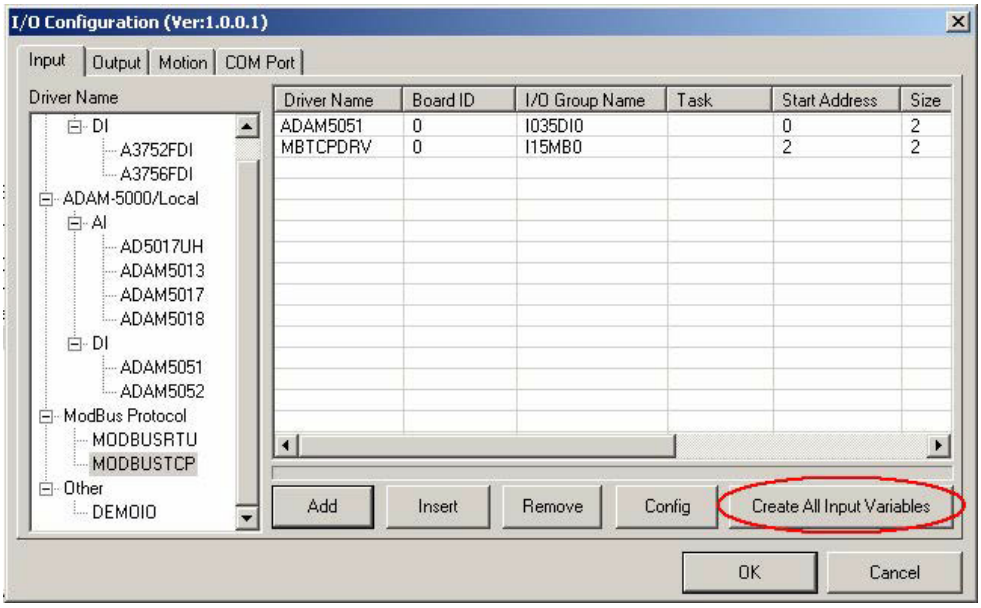
13. Click “MODBUSTCP” item and then click “Add” button.



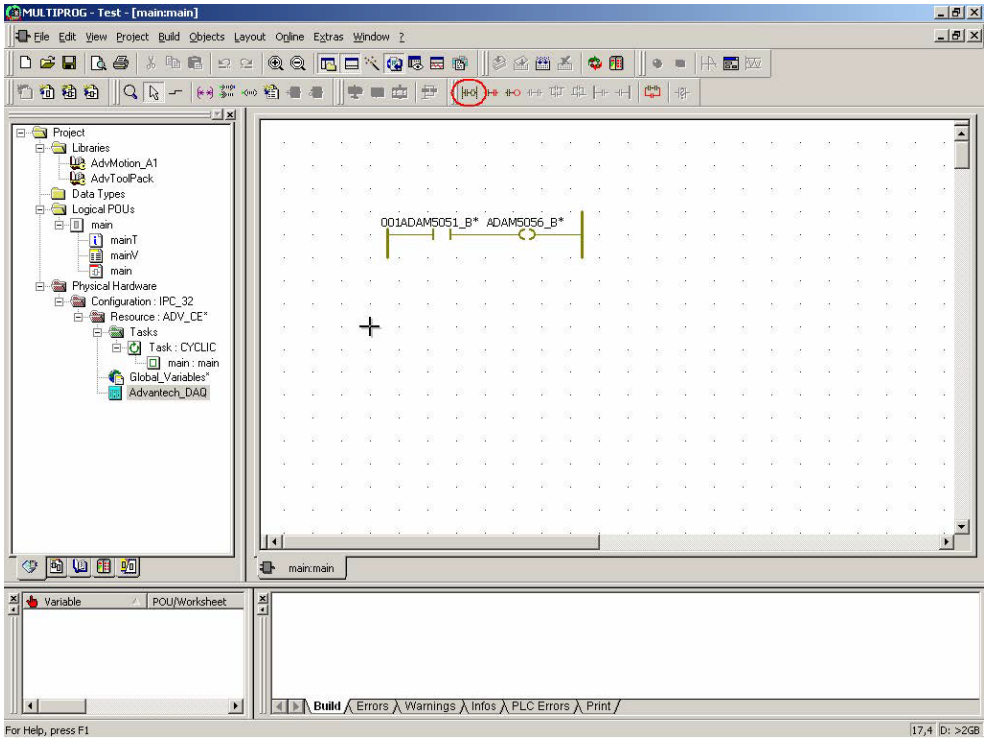
14. Set Modbus Command: “1X”, Slave ID: 1, Slave IF: “192.168.1.12”, Data Type: “BOOL”, Start Address: “1”, No. of points: 12.



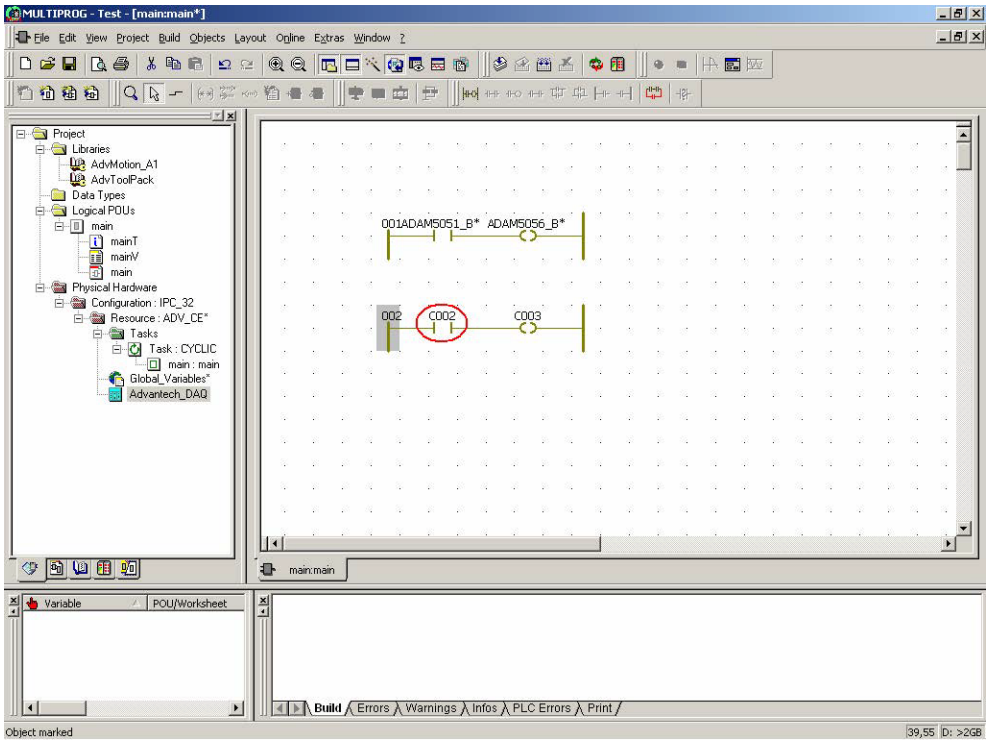
15. Click “Create All Input Variables” then click “OK” button.



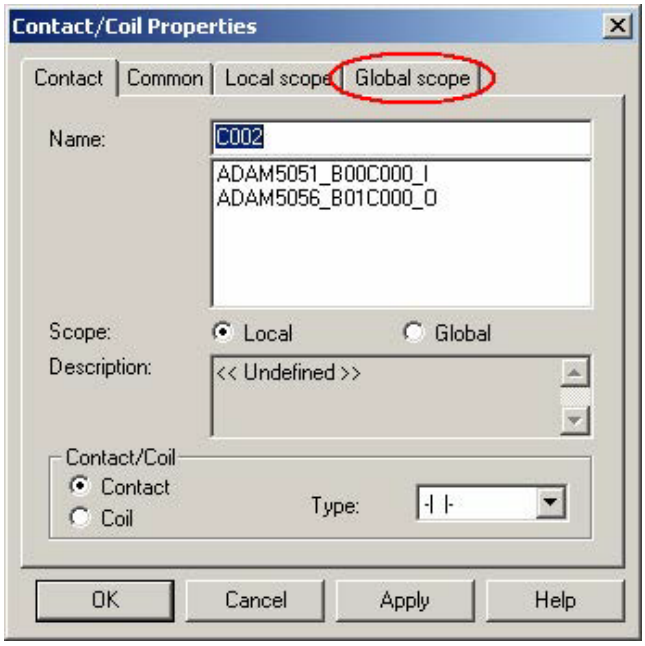
16. Click “Contact Network” button.



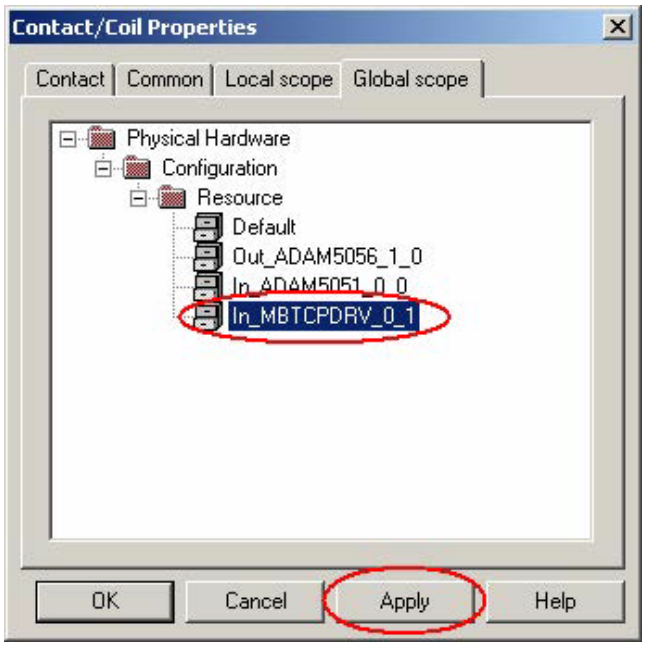
17. Double-click “C002”.



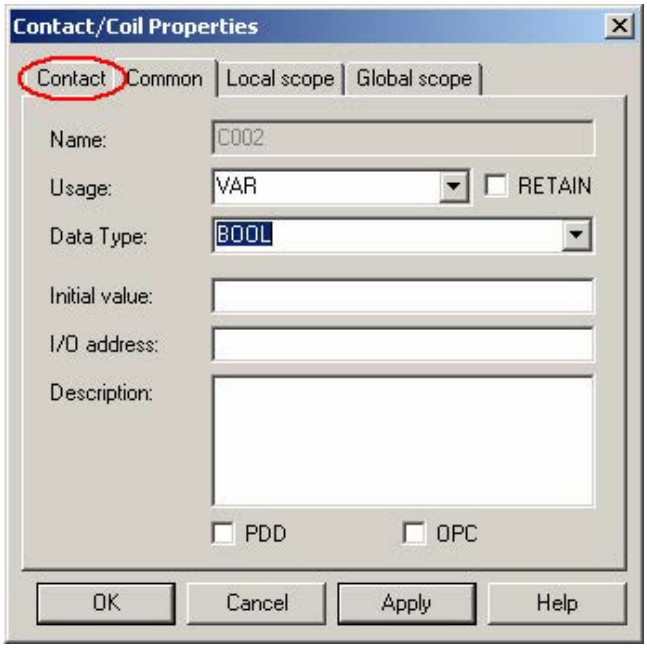
18. Click “Gloabal scope” folder.



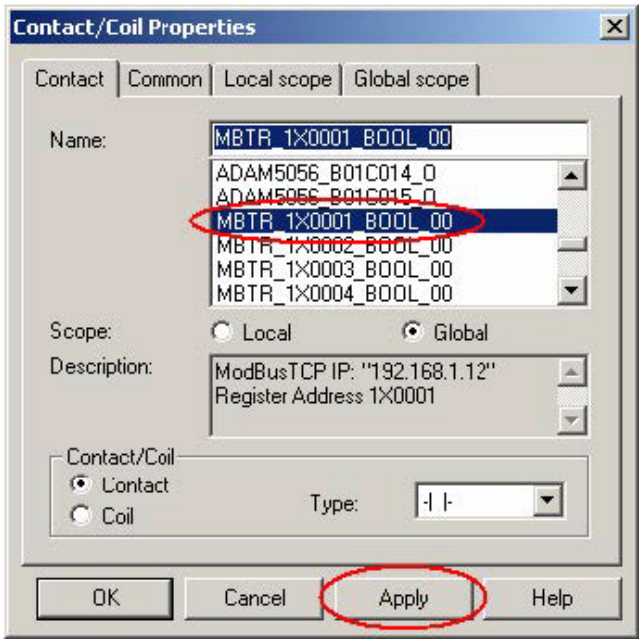
19. Select “In_MBTCPDRV_0_1” and then click “Apply”.



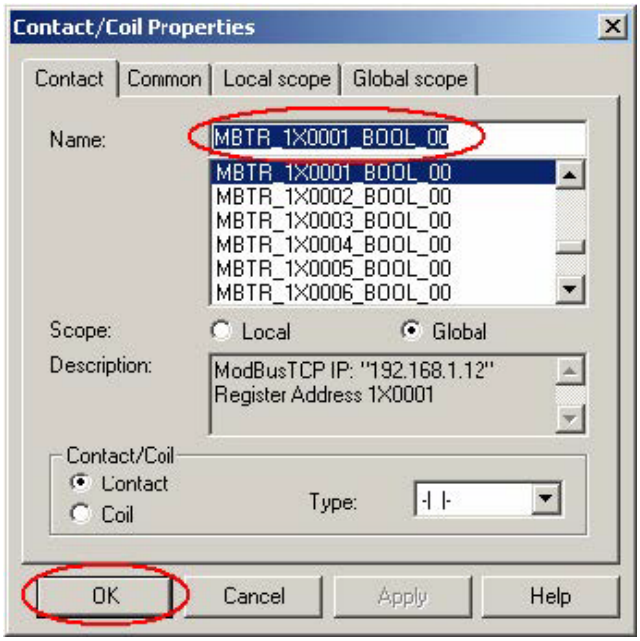
20. Click “Contact” folder.



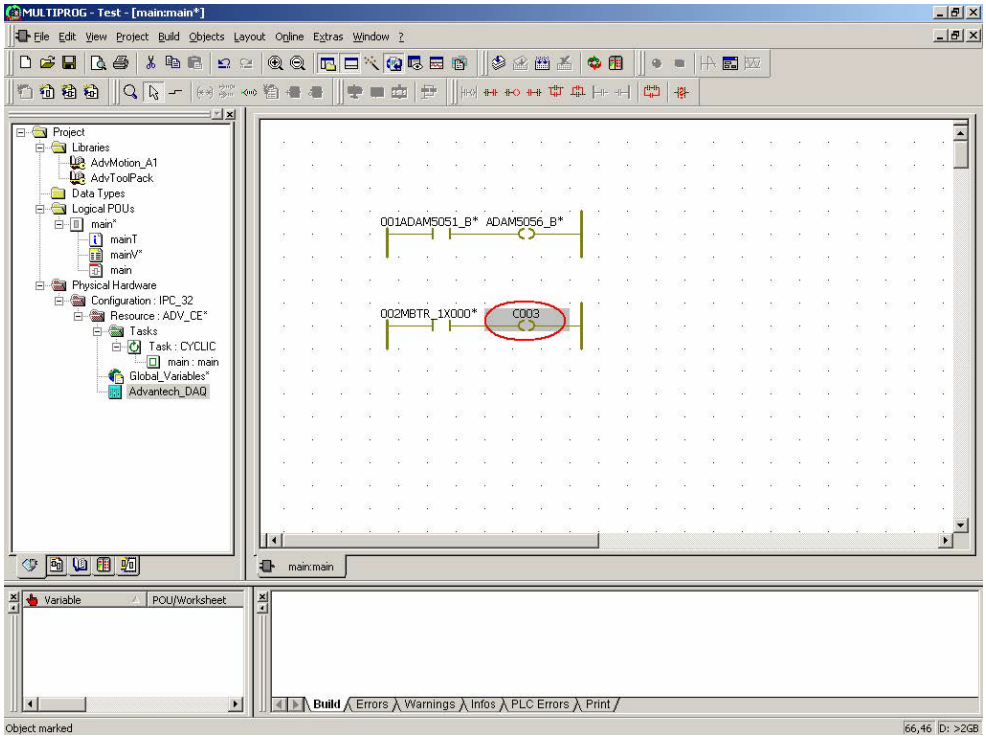
21. Select “MBTR_1X0001_BOOL_00” and then click “Apply”.



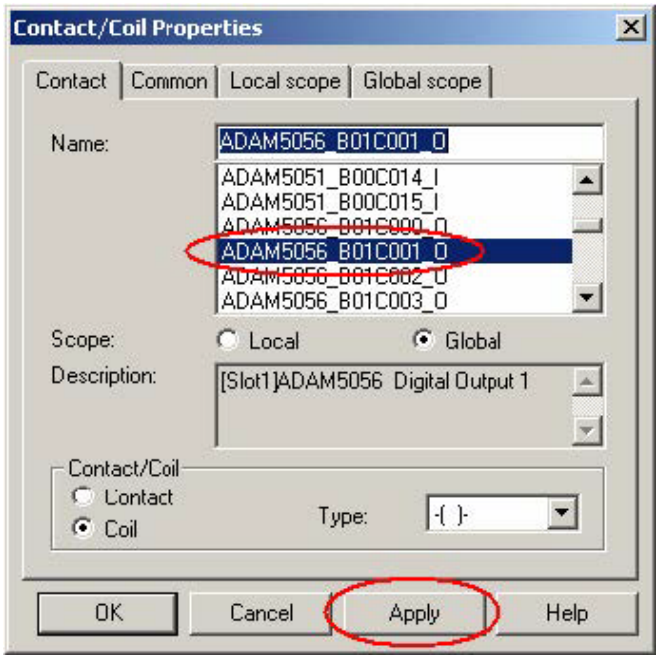
22. Check the setting is correct and then click “OK”.



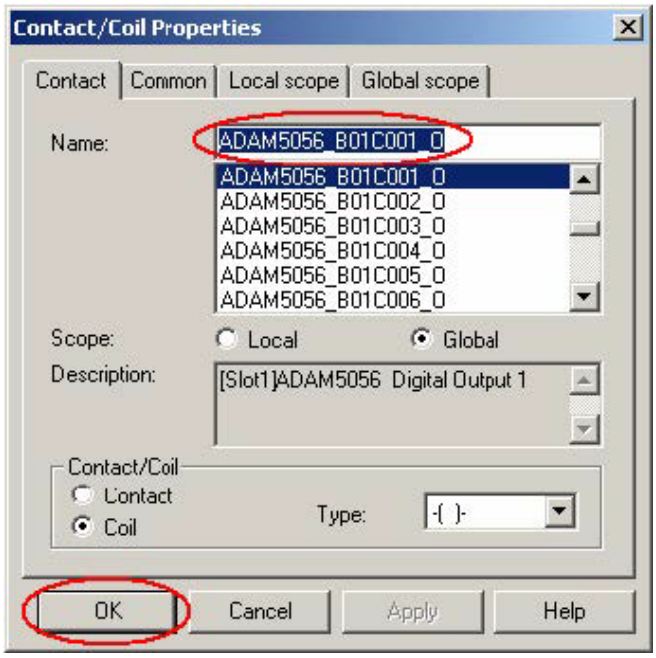
23. Double-click “C003”.



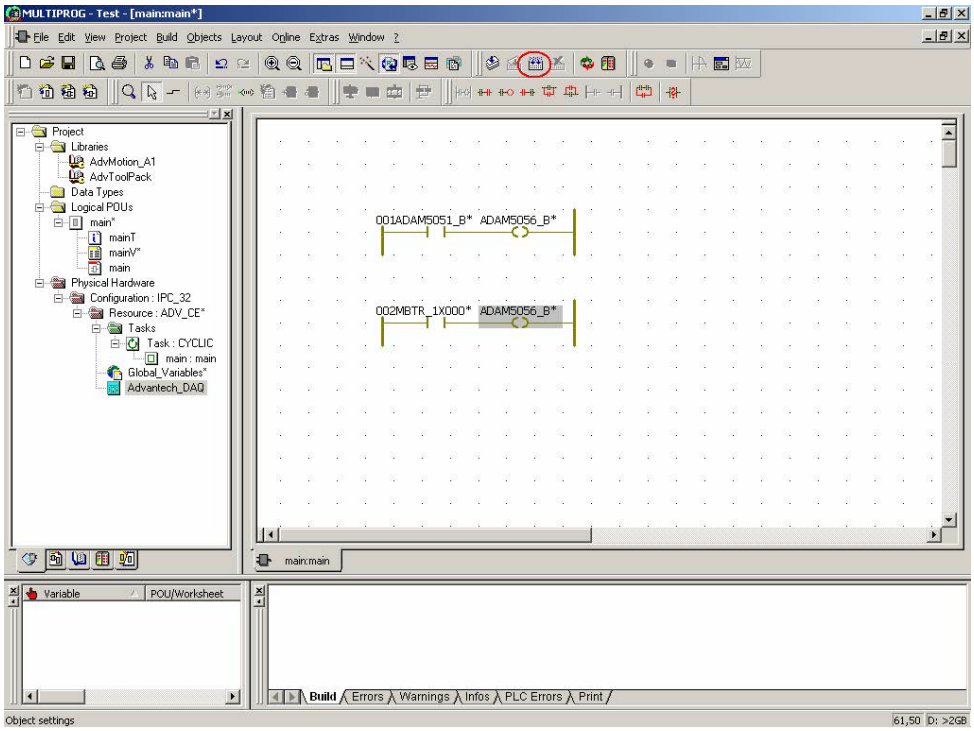
24. Select “ADAM5056_B01C001_0” and then click “Apply”.



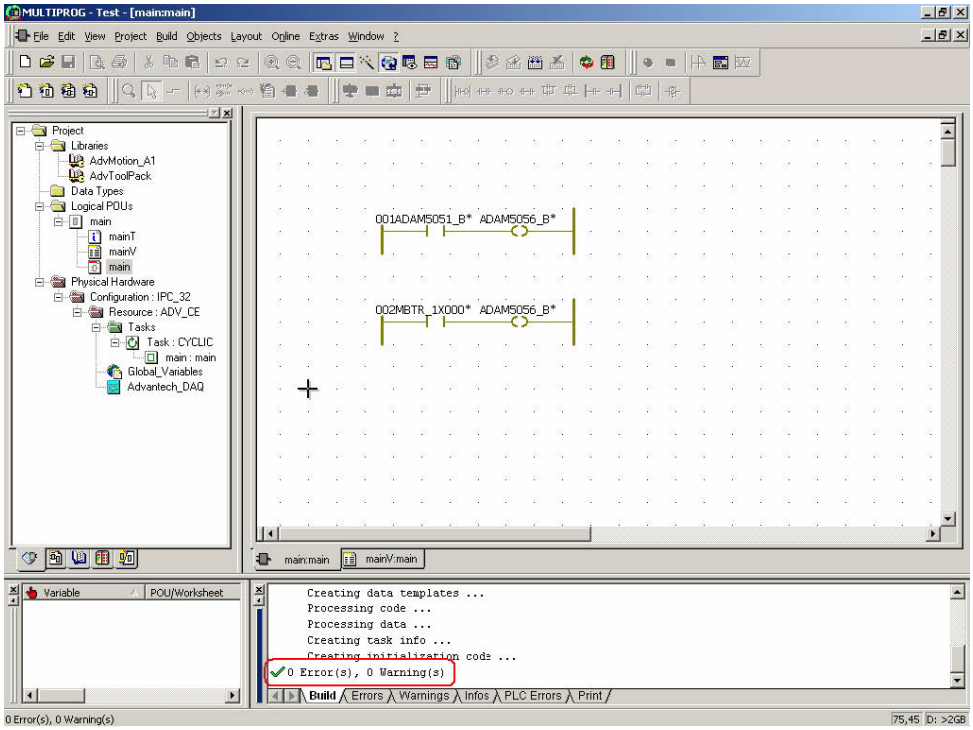
25. Check the setting is correct and then click “OK”.



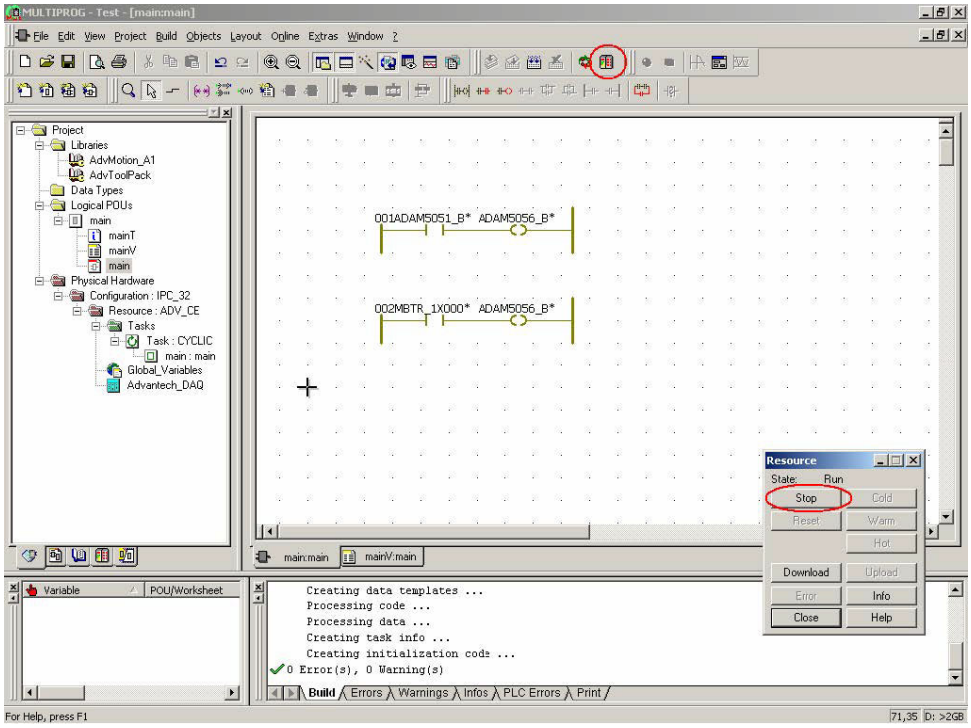
26. Click “Make” button to make the execution file.



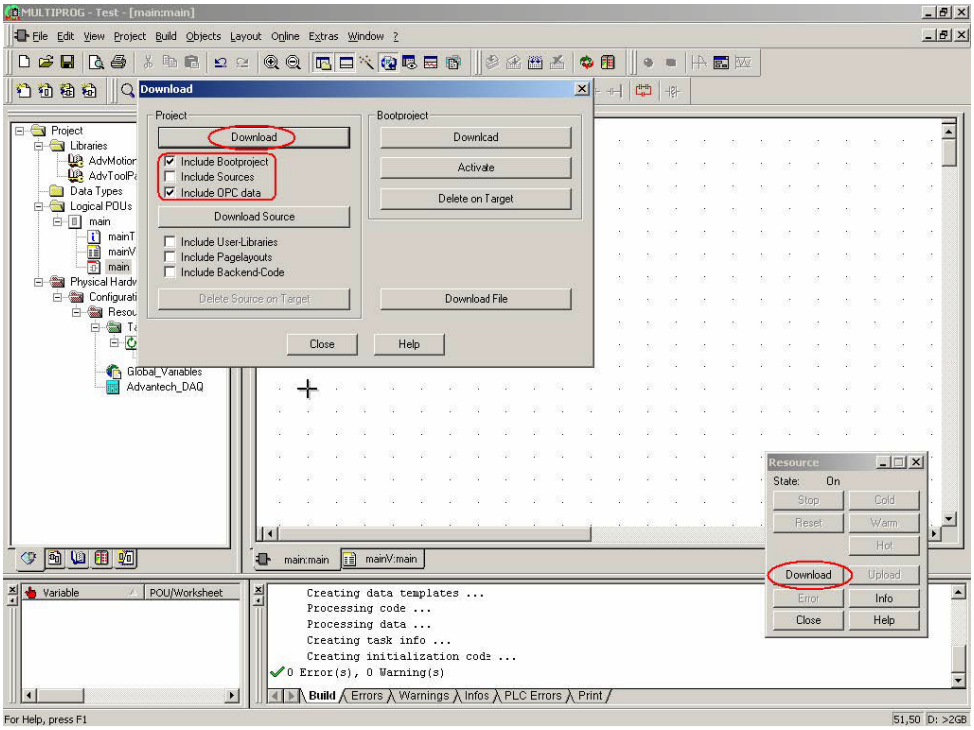
27. Check compile result is correct.



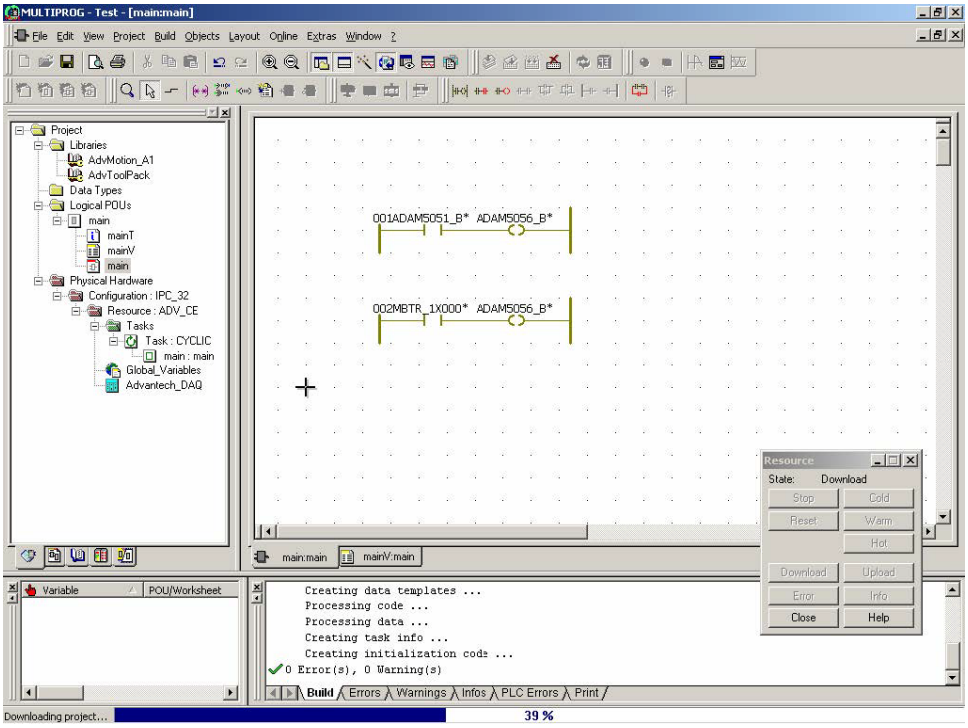
28. Click “Project Control Dialog” and then click “Stop” and “Reset”.



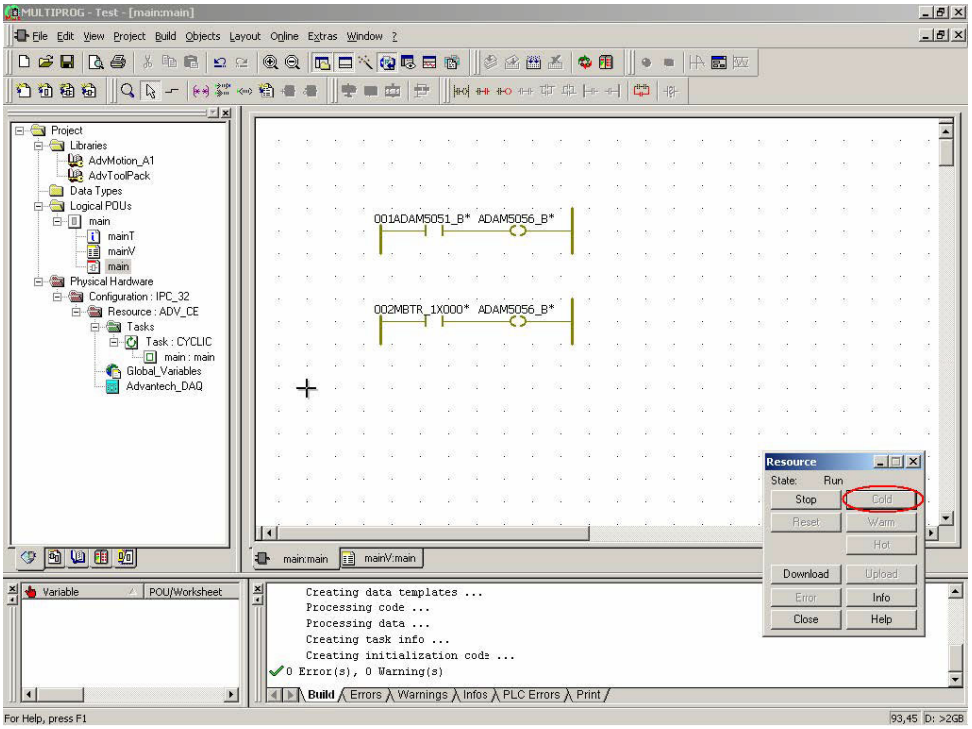
29. Click “Download” button. Check the “Include Bootproject” item and then click “Download” button to proceed with the download process.



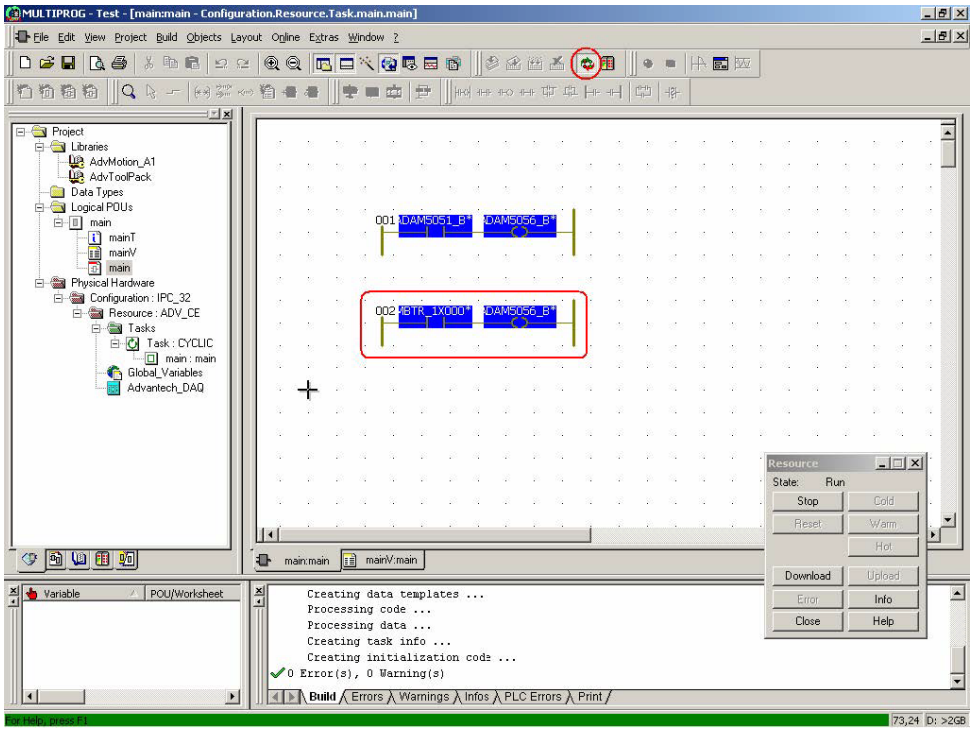
30. Execution file is downloading.



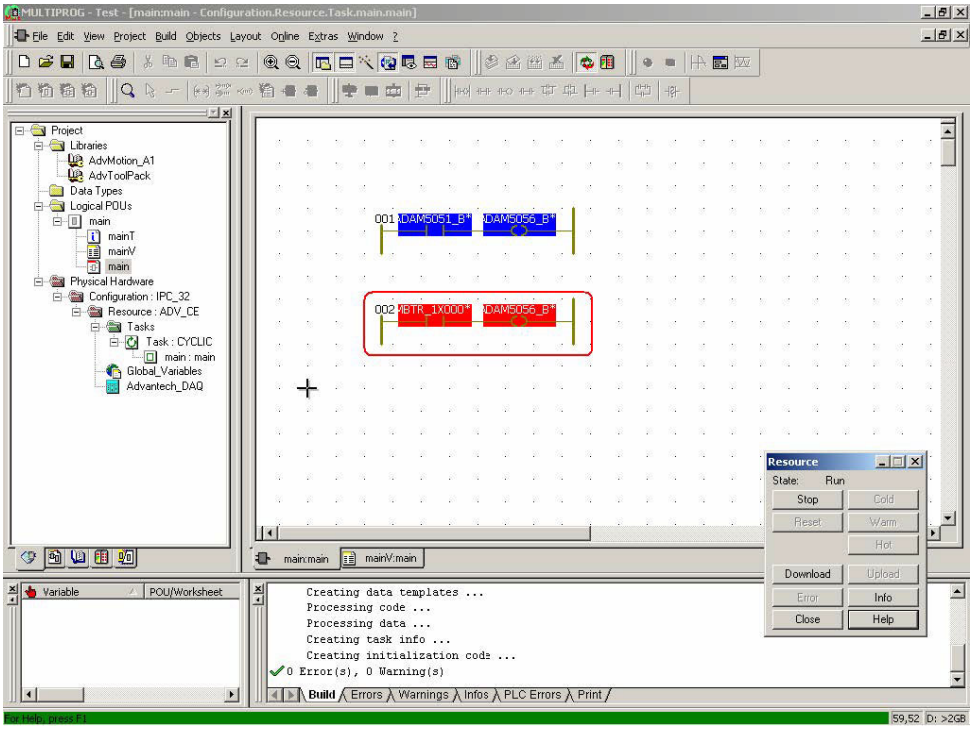
31. Click “Cold” to run the project.



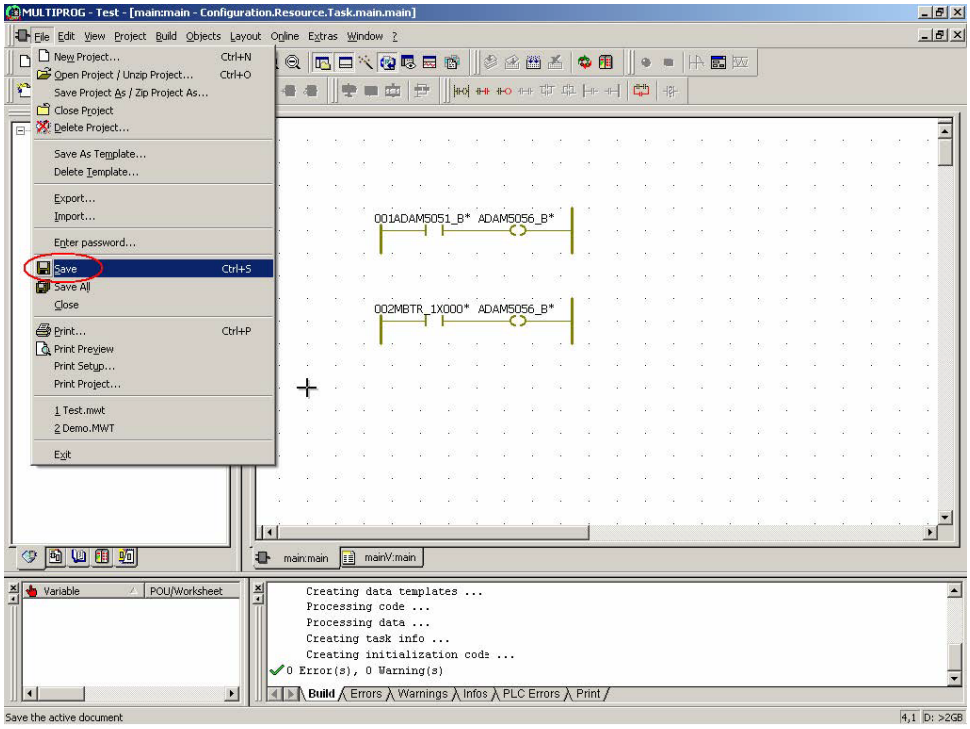
32. Check the status of ADAM-6050 DI bit 0 and ADAM-5056D DO bit 1 are OFF.



33. Turn on ADAM-6050 DI bit 0 and check the status of ADAM-5056D DO bit 1 is turned ON correctly.



34. Save the project properly.



4.3 Modbus/RTU Master Function

The Modbus/RTU master function is supported by COM1/COM2/COM4 RS-485 Ports of ADAM-5560 Series Controller. There are typical 128 I/O modules can be connected to each COM port. So far, there are 12 modules of ADAM-4000 Series support modbus protocol as following list. (Please refer to ADAM-4000 User's Manual for latest support list.)

Module Name	Description
ADAM-4015	6-channel RTD Input Module
ADAM-4015T	6-channel Thermistor Input Module
ADAM-4017+	8-channel Analog Input Module
ADAM-4018+	8-channel Thermocouple Input Module
ADAM-4022T	Dual-loop PID Controller
ADAM-4024	4-channel Analog Output Module

Module Name	Description
ADAM-4051	16-channel Isolated Digital Input Module
ADAM-4055	16-channel Isolated Digital Input/Output Module
ADAM-4056S	12-channel Sink Type Isolated Digital Output Module
ADAM-4056SO	12-channel Source Type Isolated Digital Output Module
ADAM-4068	8-channel Relay Output Module
ADAM-4069	8-channel Power Relay Output Module

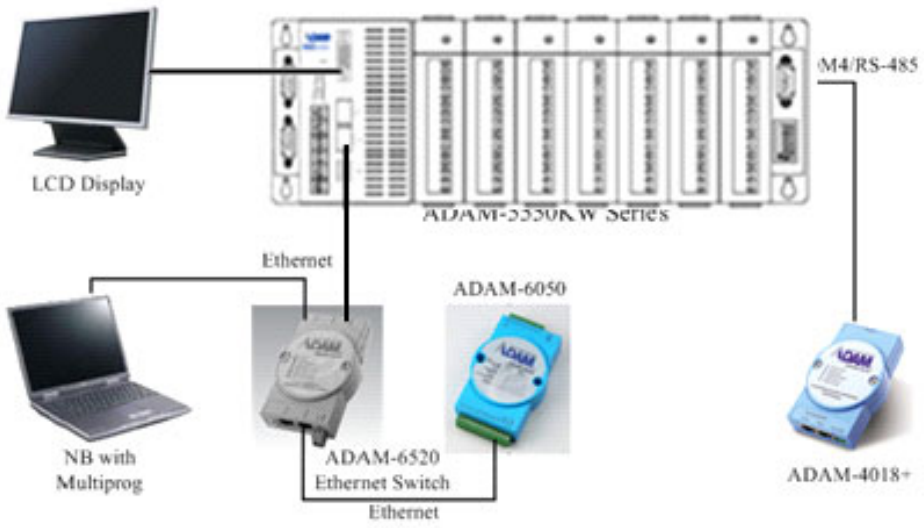
4.3.1 Modbus/RTU Master Function Example

ADAM-4018+ settings:
ID address: 01
Typr K thermocouple applied to CH0 (0~1370ºC)

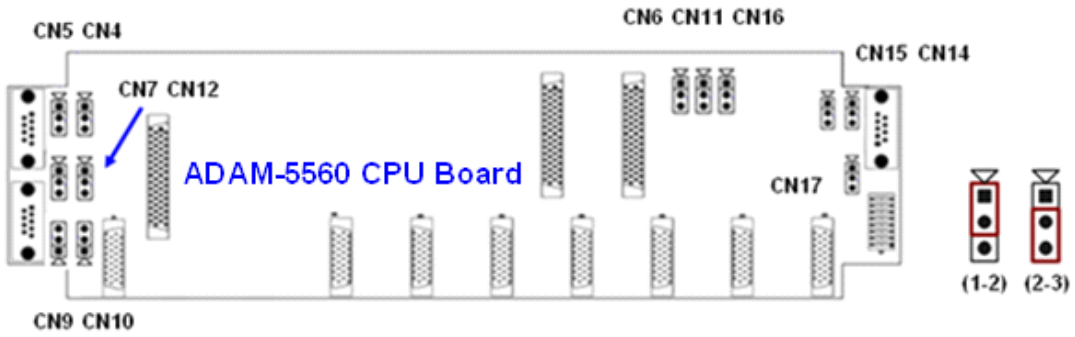
ADAM-6050 settings: (for following previous example)
IP address: 192.168.1.12

ADAM-5560 Series Controller settings:
Slot 0: ADAM-5051D
Slot 1: ADAM-5056D
IP address: 192.168.1.5

System Wiring:



COM4 Jumper Settings:



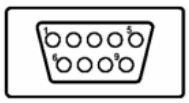
COM4 Setting	CN14	CN15	CN16
RS-232 (Default)	(1-2)	(1-2)	(1-2)
RS-485	(2-3)	(2-3)	(2-3)

COM4 RS-485 TR Setting	CN17
120 ohm	(1-2)
300 ohm	(2-3)

Note! *After changing the jumper settings, please reset the ADAM-5560 Series Controller.*

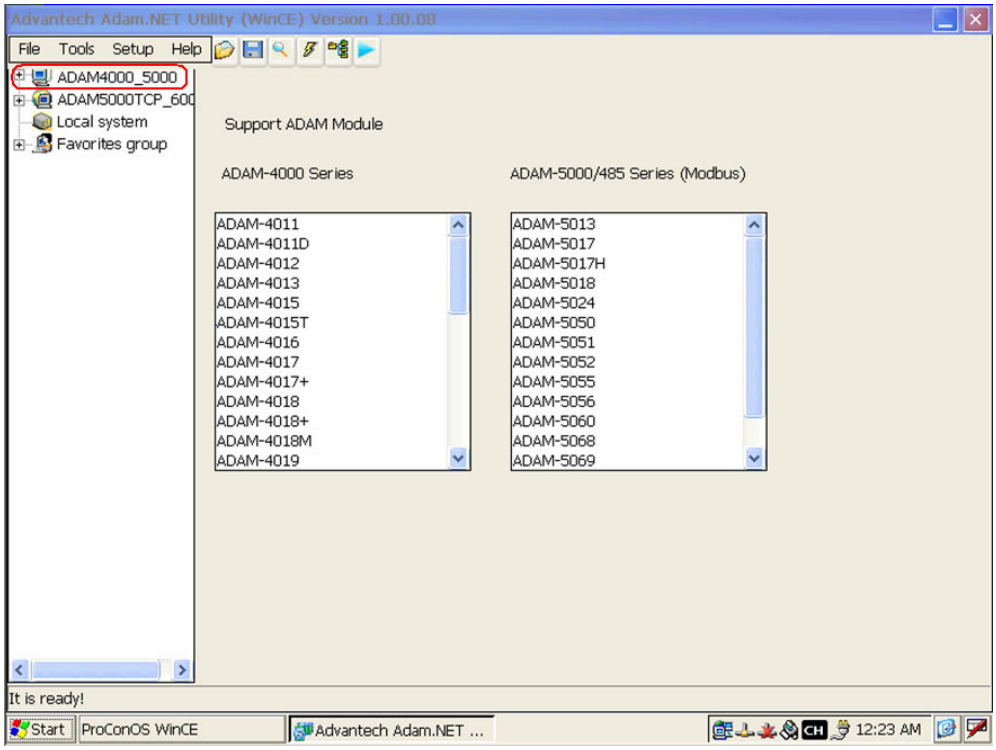
RS-485 Port Pin Assignment:

Pin No.	Description
Pin 1	DATA-
Pin 2	No Connection
Pin 3	No Connection
Pin 4	DATA+
Pin 5	No Connection
Pin 6	No Connection
Pin 7	No Connection
Pin 8	No Connection
Pin 9	No Connection

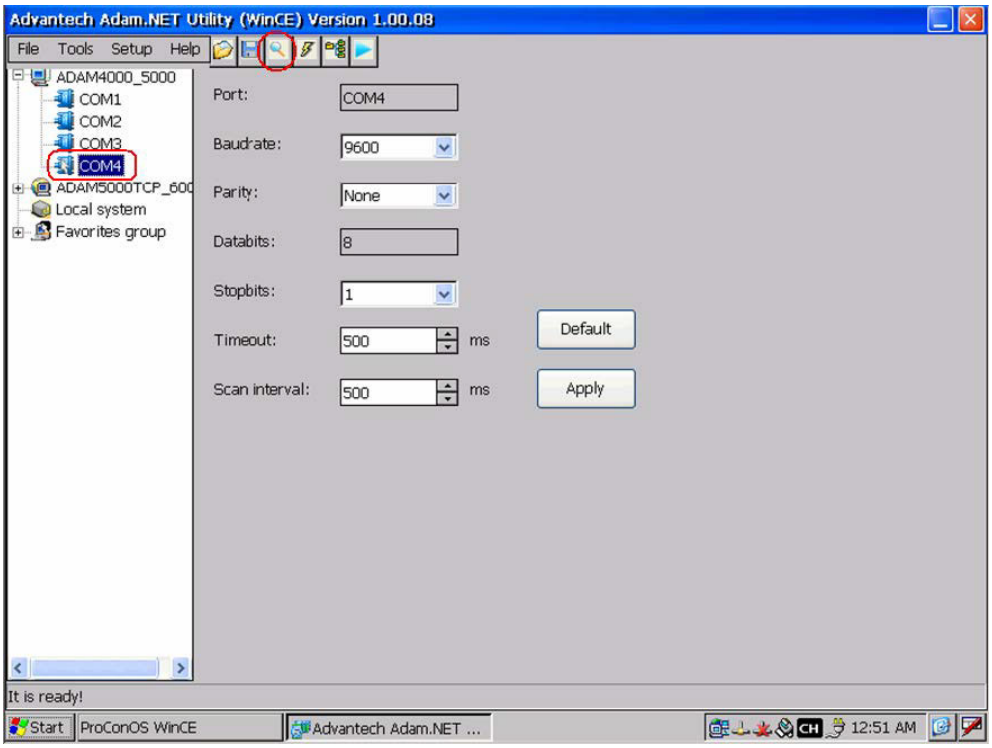


1. ***[PAC Device]*** Run ADAM.NET utility by clicking “Start” -> “Programs” -> “Advantech” -> AdamNET Utility.

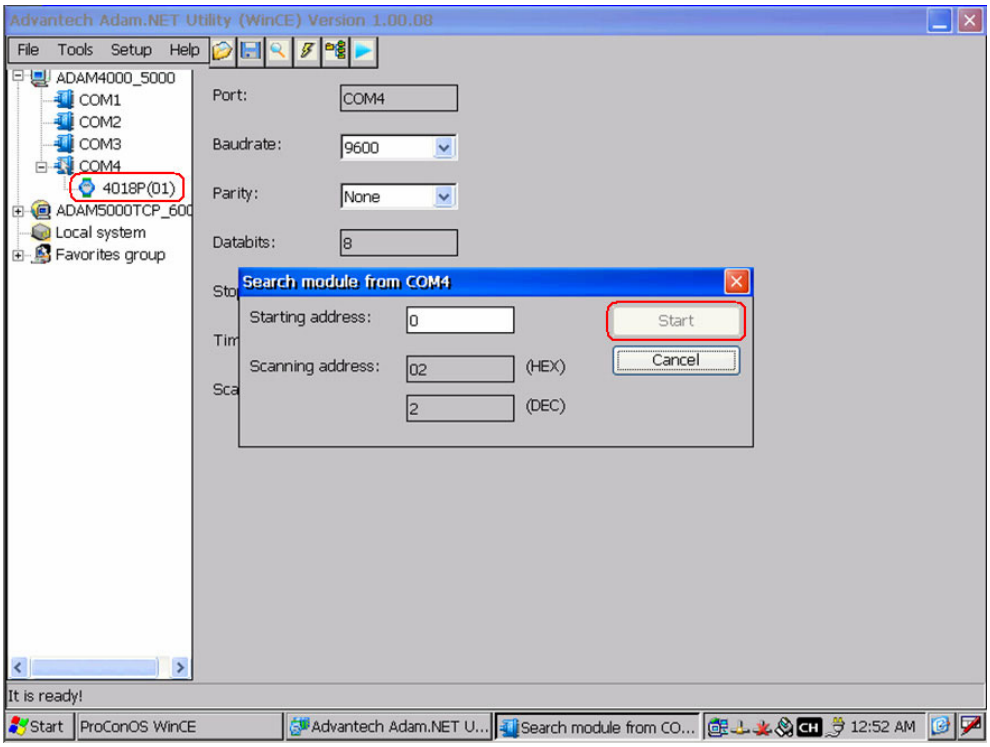
2. ***[PAC Device]*** Select “ADAM4000_5000” item.



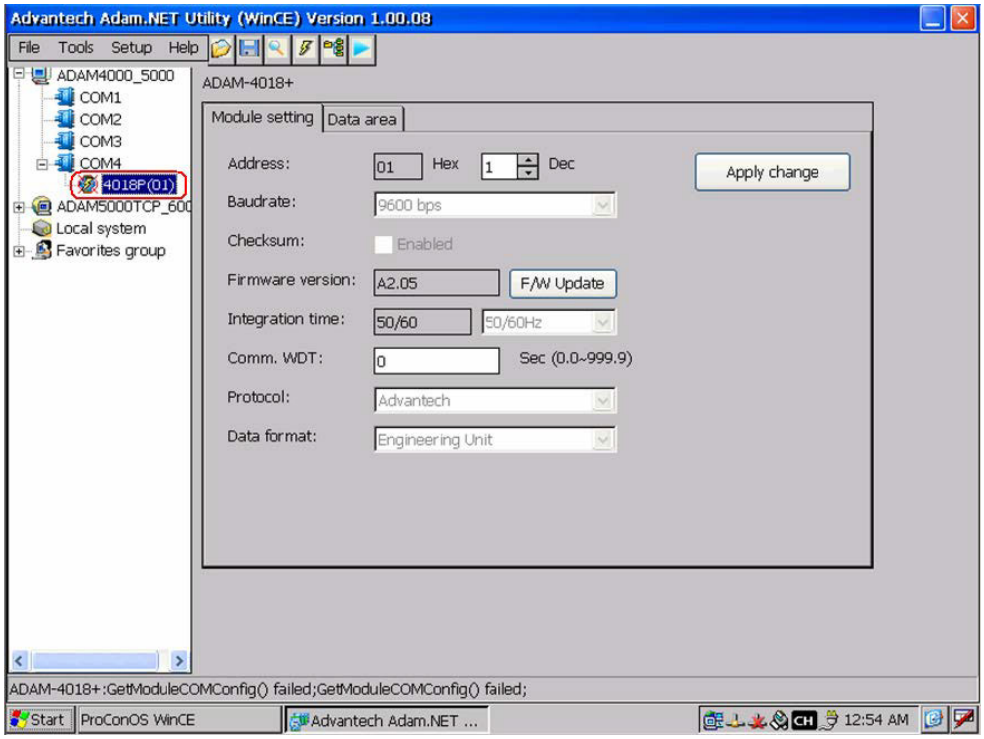
3. ***[PAC Device]*** Select “COM4” and then click “Search” button.



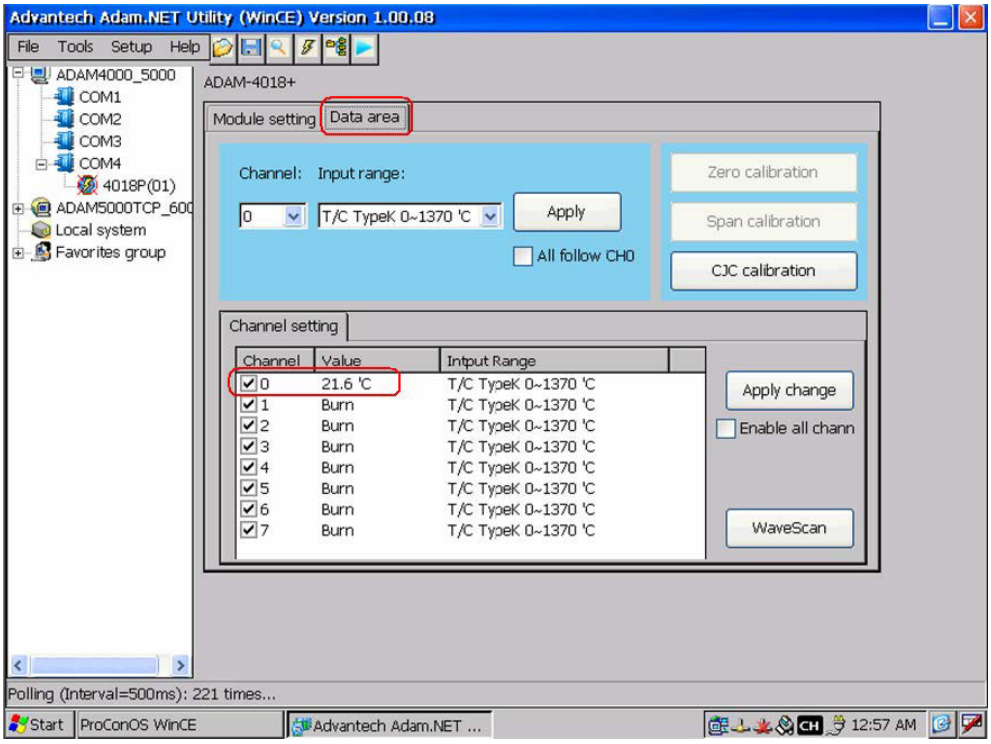
4. ***[PAC Device]*** Click “Start” button and “4018P” will be shown.



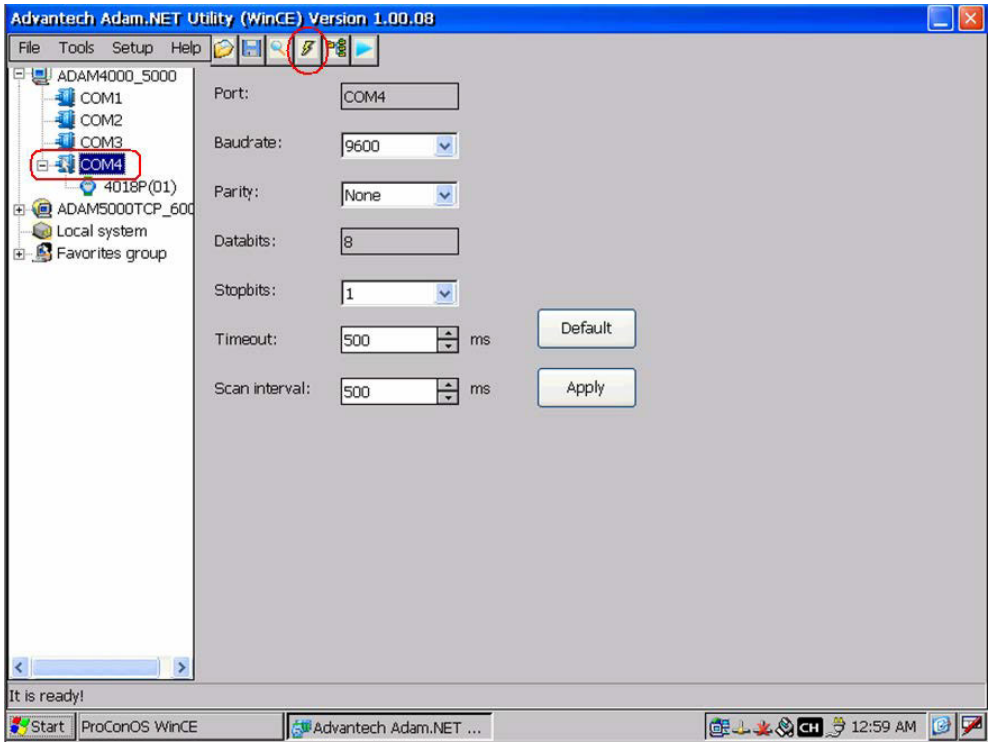
5. ***[PAC Device]*** Click “4018P” to see the module setting.



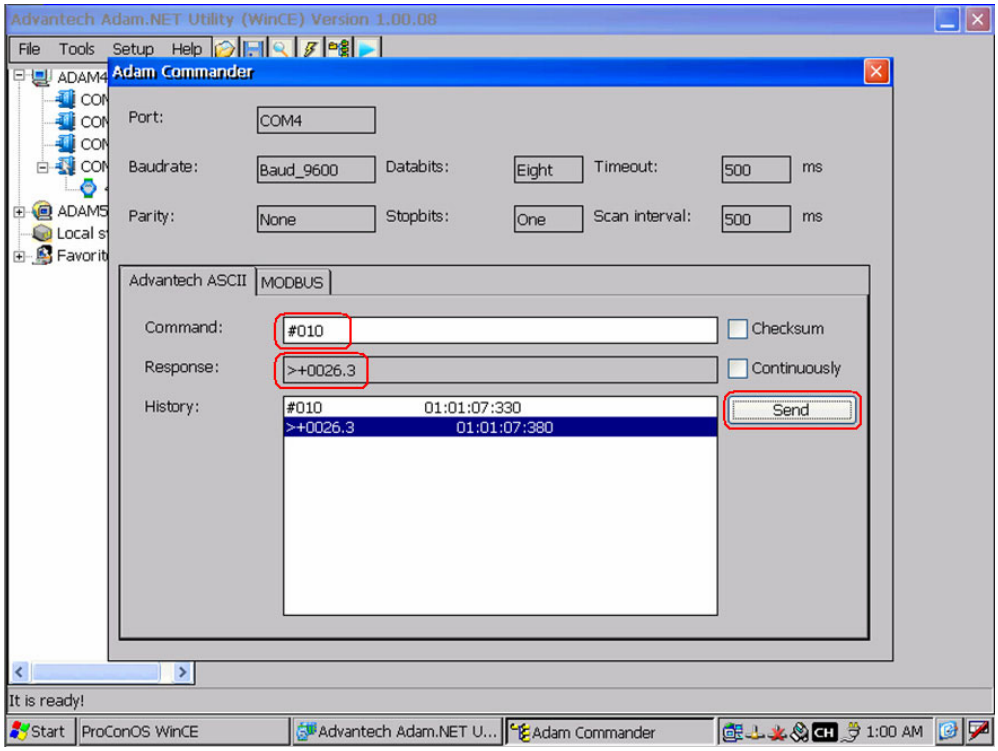
6. ***[PAC Device]*** Click “Data area” to check the reading of Channel 0 is correct. This channel will be used by following demonstration.



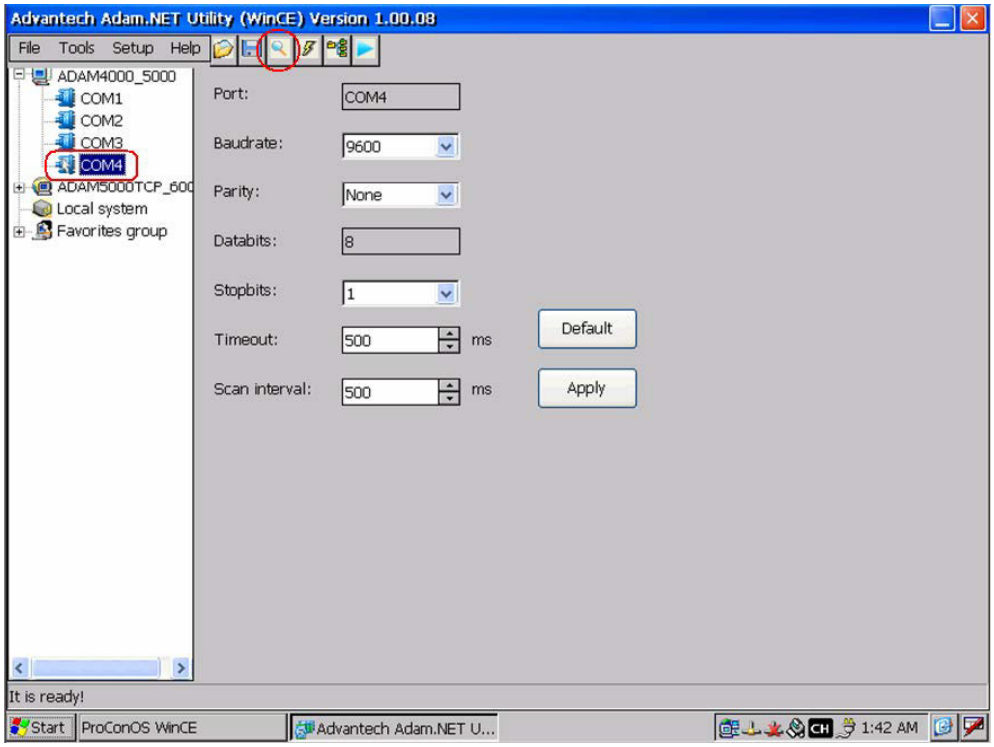
7. ***[PAC Device]*** Select “COM4” and then click “Adam Commander” button.



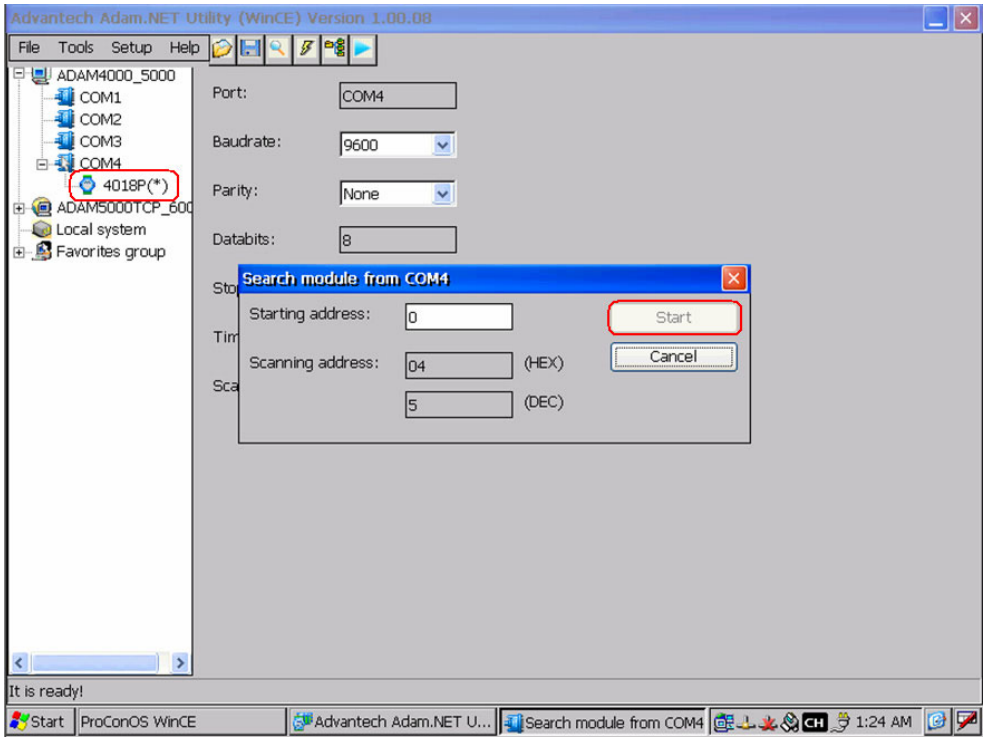
8. ***[PAC Device]*** Input “#010” and click “Send”. Check the response of the CH0 reading is correct.



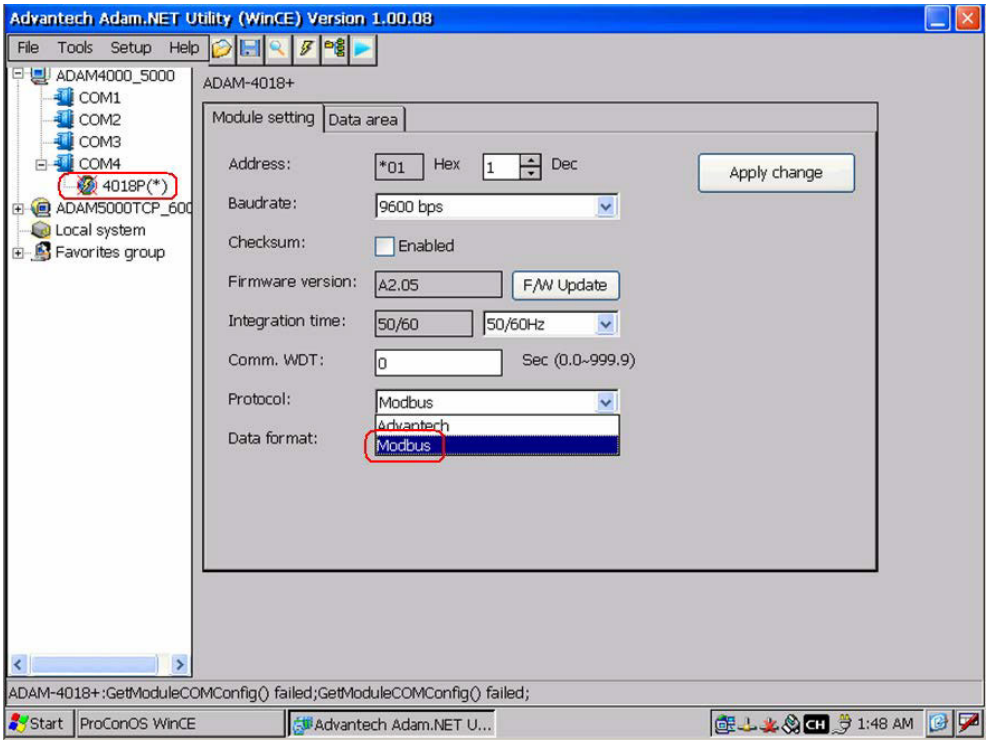
9. ***[PAC Device]*** Set the ADAM-4018+ to initial mode by changing the switch position to “Init” side and then resetting the module. The switch is at the left side of the module. After that, select “COM4” and then click “Search” button again.



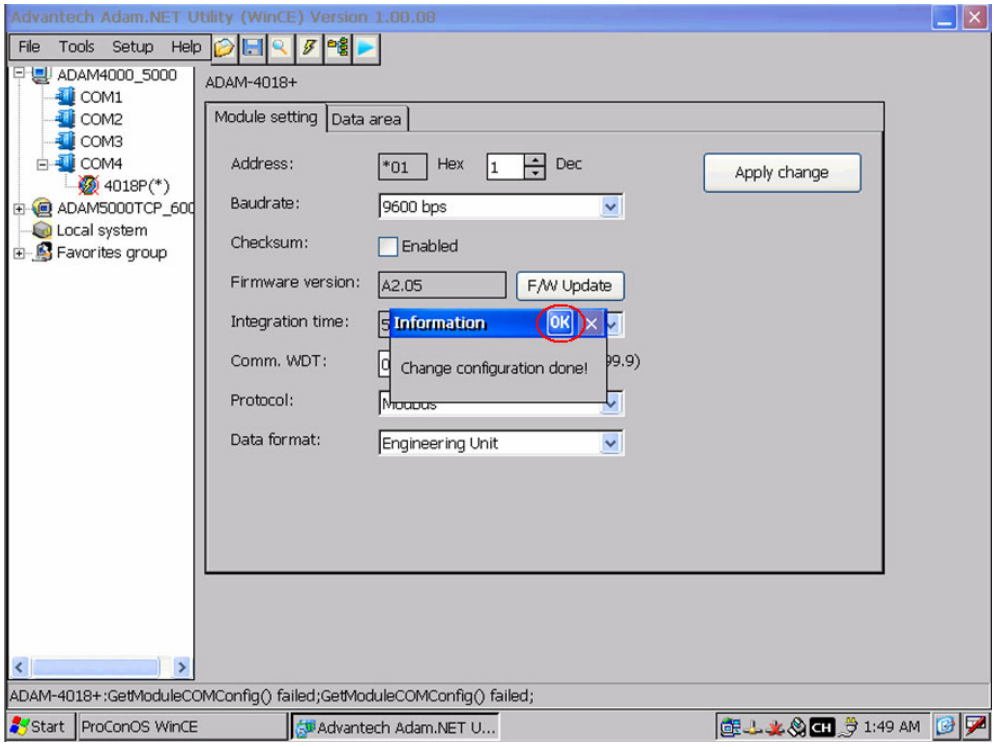
10. ***[PAC Device]*** Click “Start” and “4018(*)” will be shown. “*” represents the module is at initial mode.



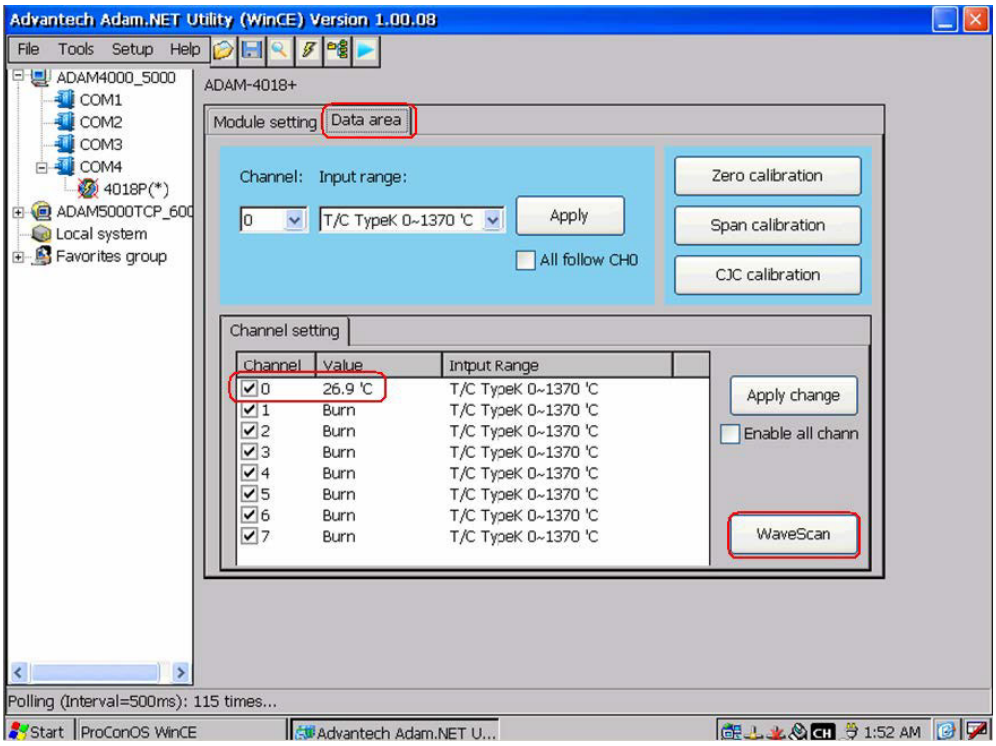
11. ***[PAC Device]*** Select “4018P(*)” and then change the Protocol setting to “Modbus”.



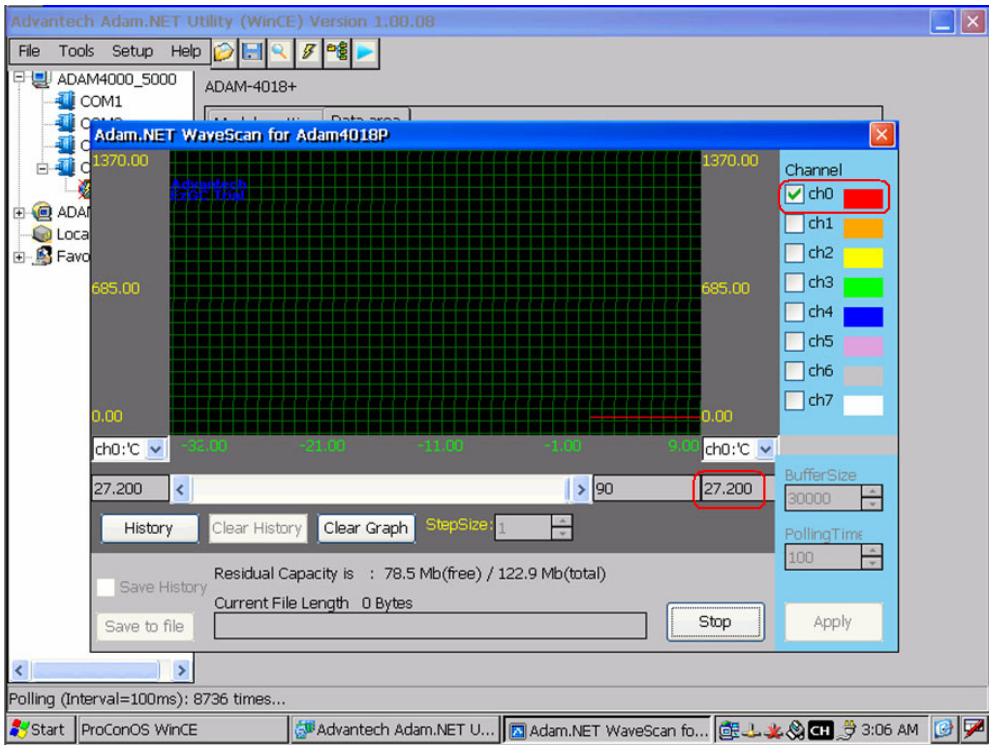
12. ***[PAC Device]*** Click “OK” to change the setting.



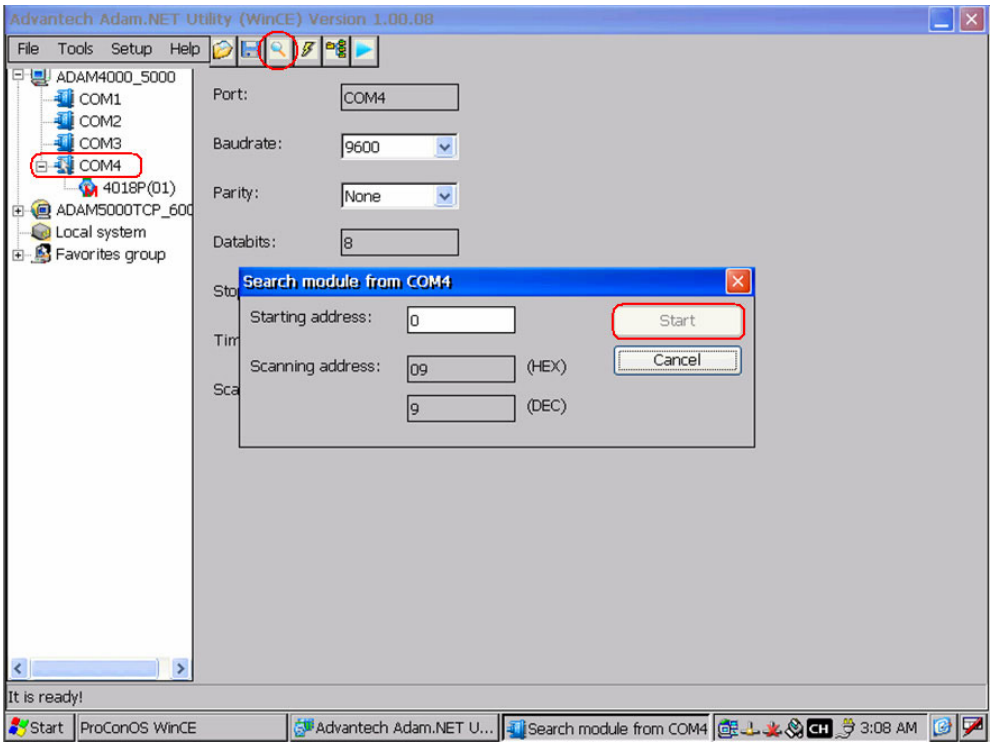
13. ***[PAC Device]*** Select “Data area” and check the CH0 reading. Click “WaveScan” to see the wavescan window.



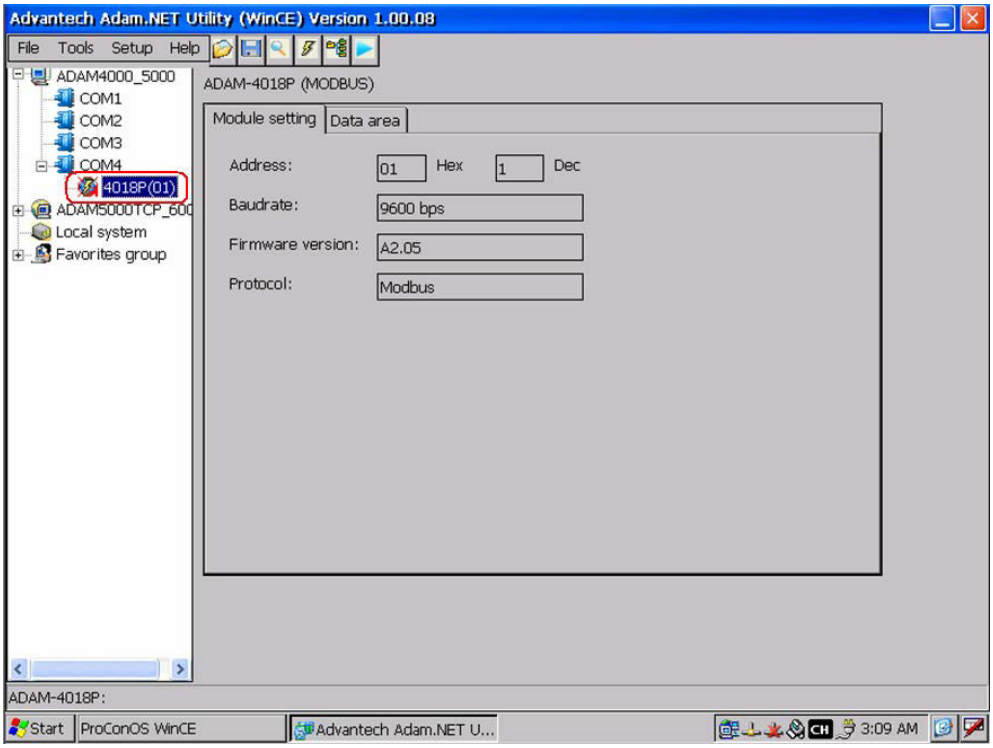
14. ***[PAC Device]*** Check CH0 reading and then close the window.



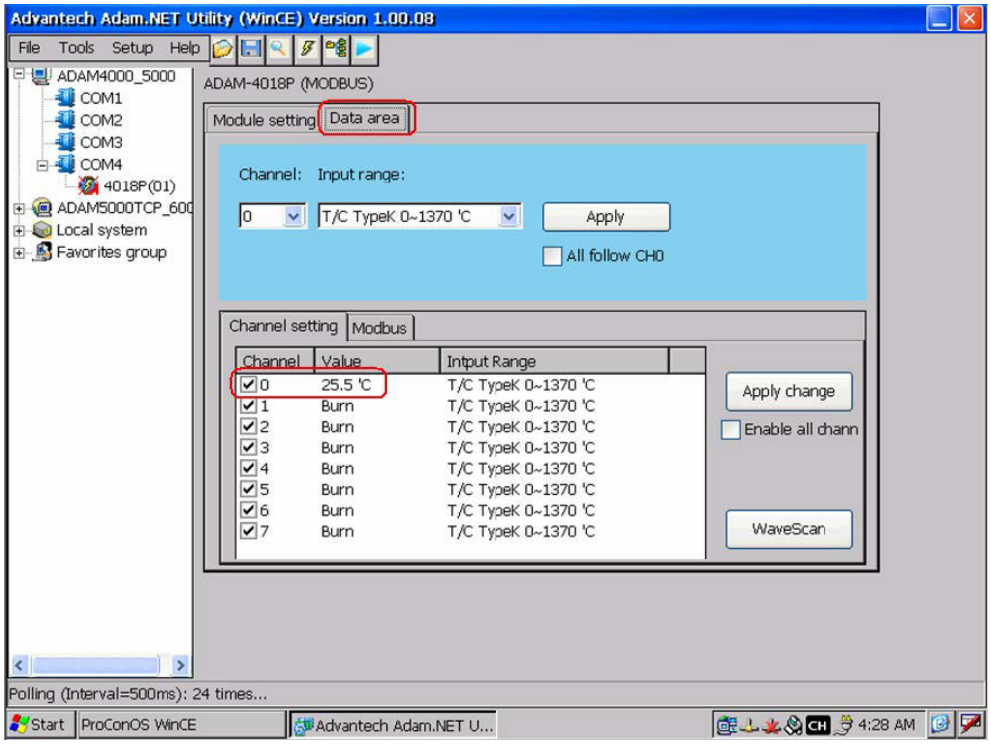
15. ***[PAC Device]*** Set the ADAM-4018+ to normal mode by changing the switch position to “Normal” side and then resetting the module. After that, select “COM4” and then click “Search” and “Start” buttons.



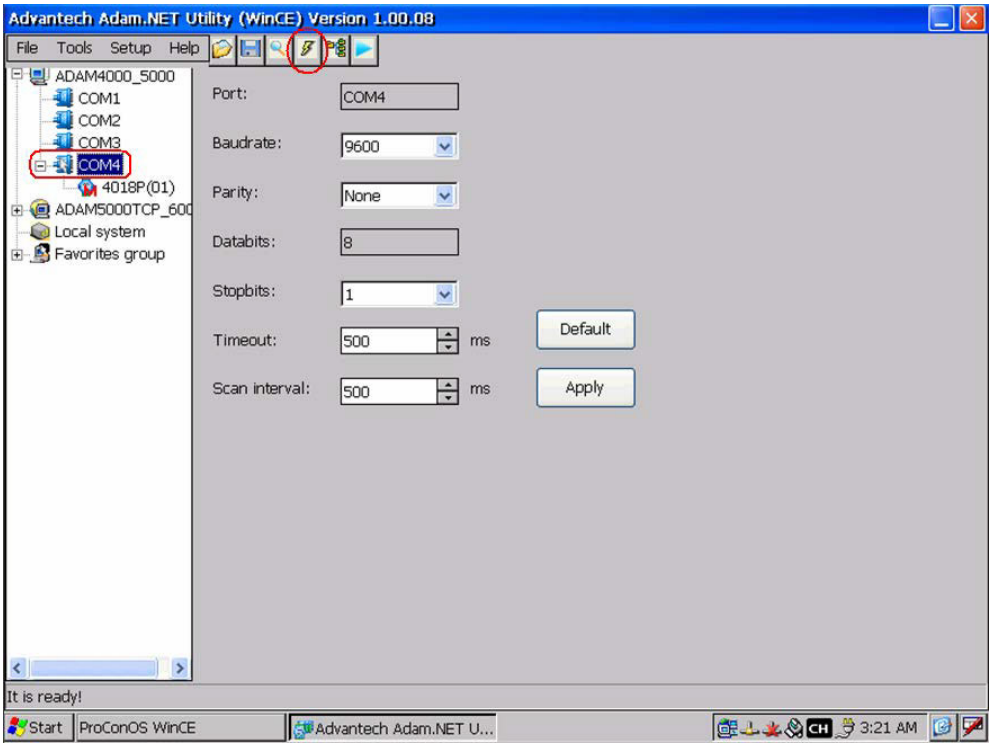
16. ***[PAC Device]*** Click “4018P(01)” to see the module setting.



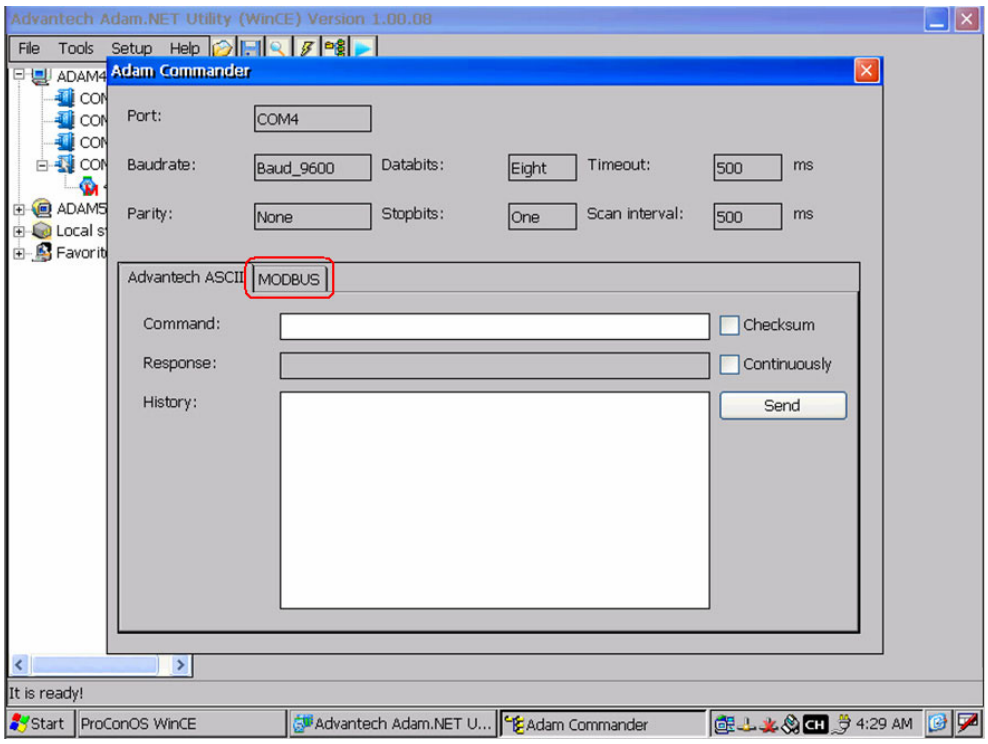
17. ***[PAC Device]*** Select “Data area” folder and check CH0 reading.



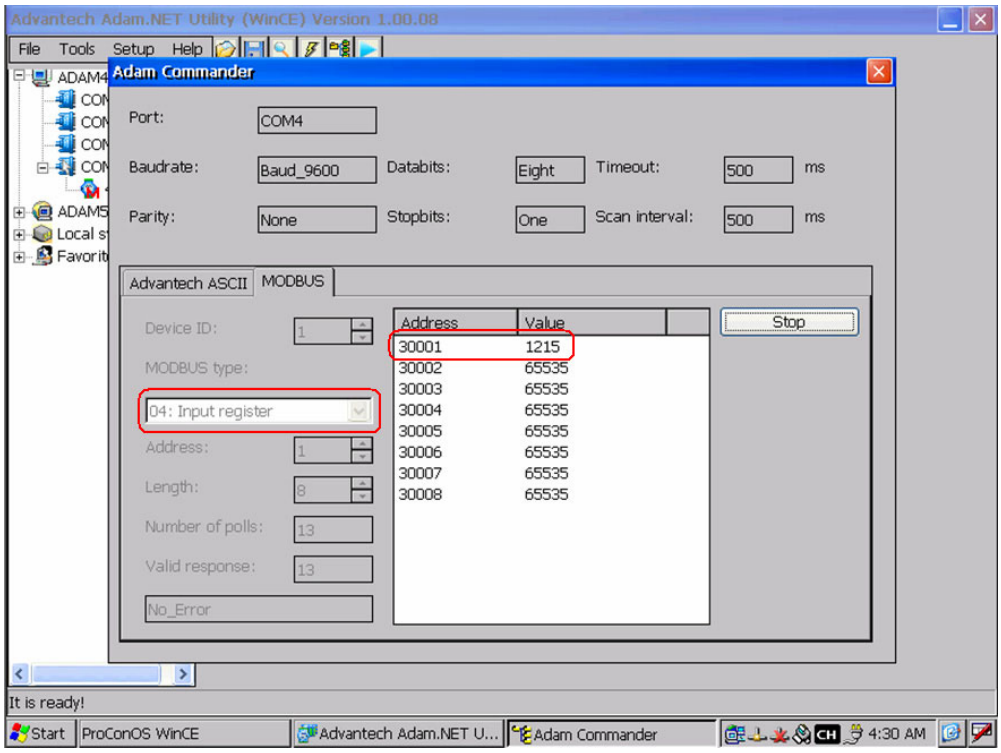
18. ***[PAC Device]*** Select “COM4” and then click “Adam Commander”.



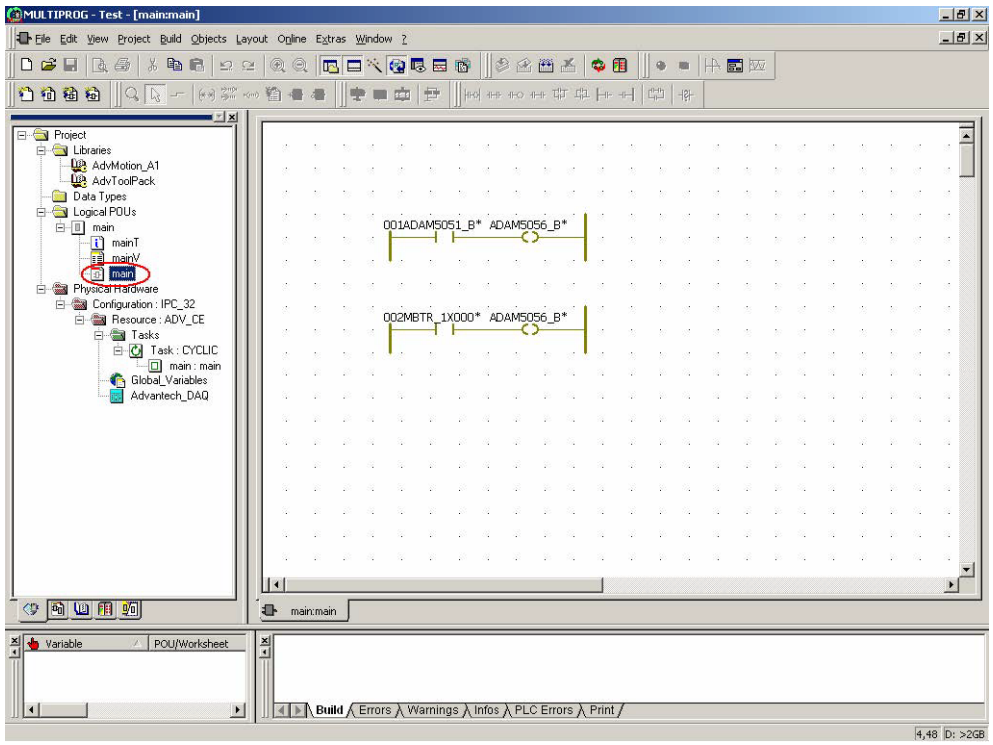
19. ***[PAC Device]*** Change to “MODBUS” folder.



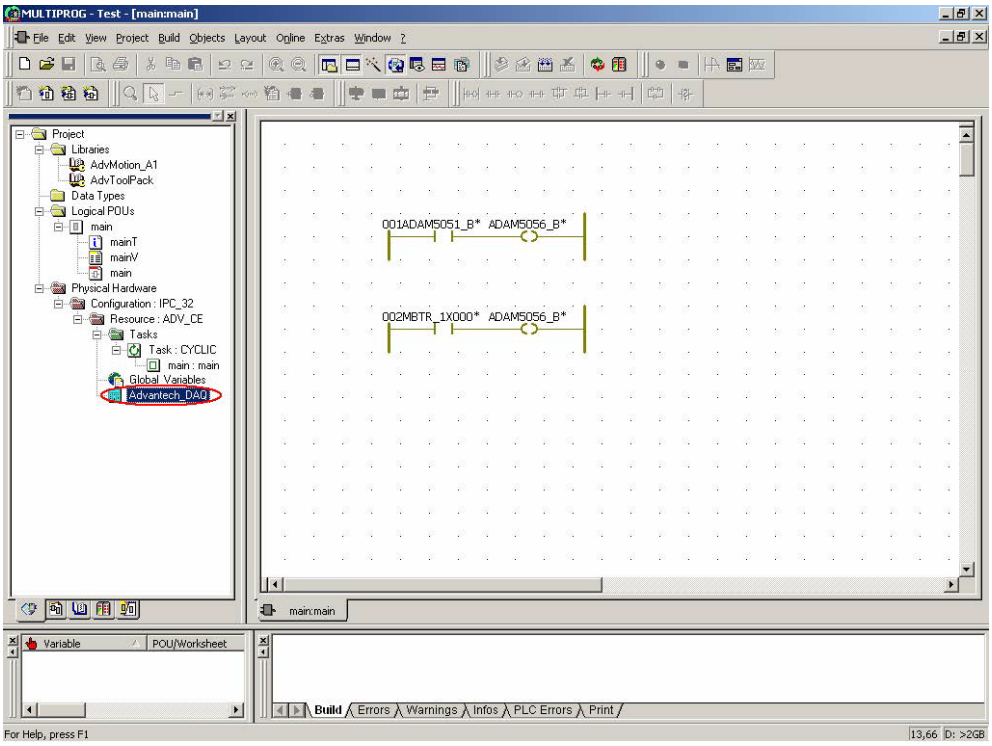
20. ***[PAC Device]*** Check the reading of CH0. The formula is (1215*1370) / 65536 = 25.4 ºC.



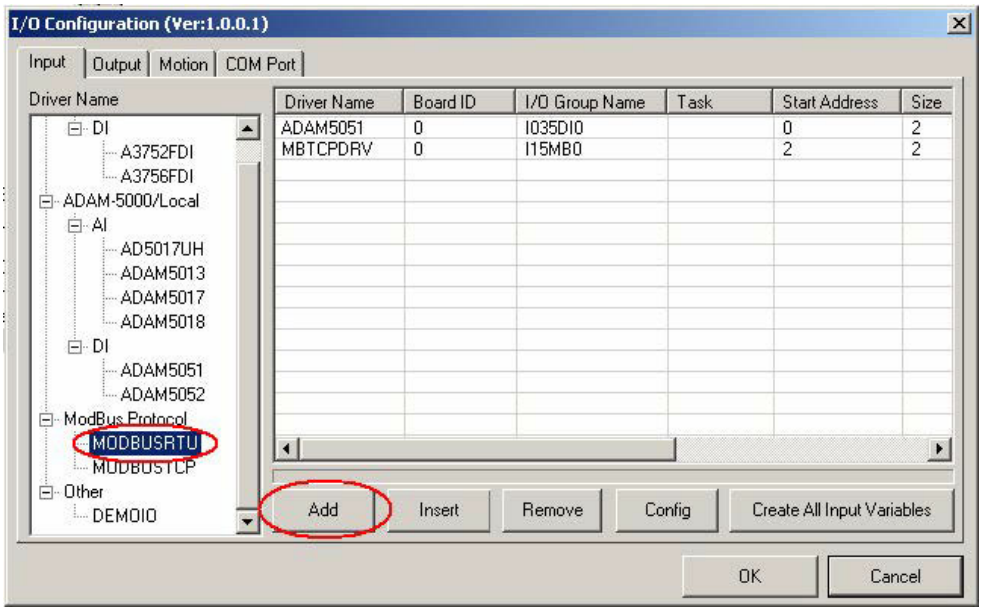
21. Open the “Test.mwt” project and then double-click “main”.



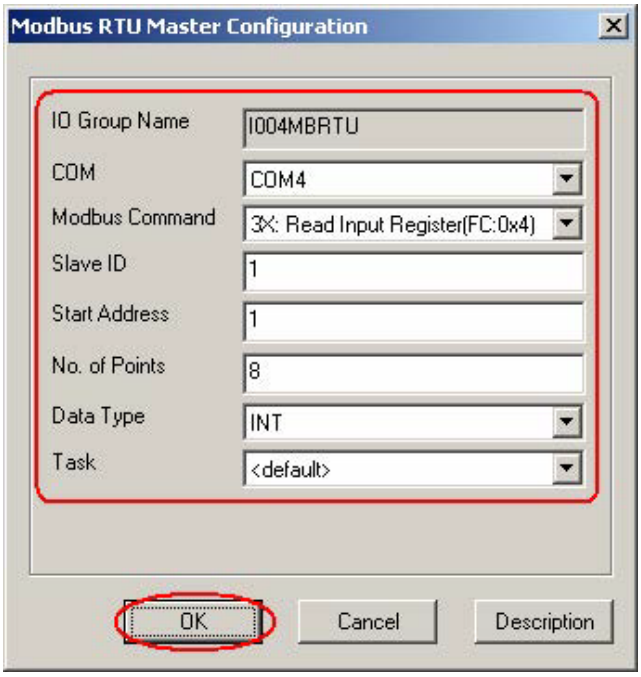
22. Double-click “Advantech_DAQ”.



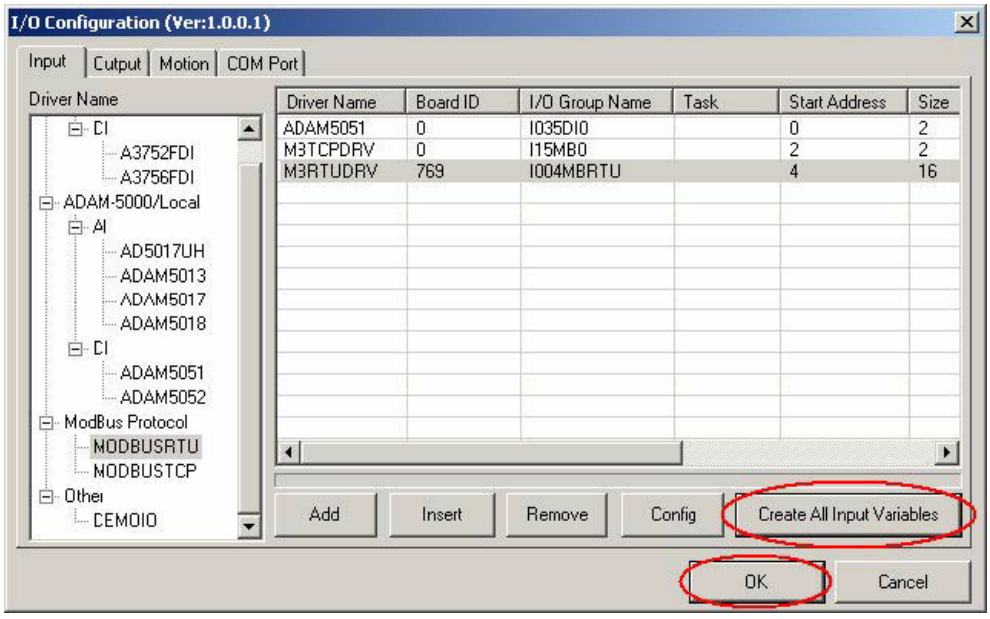
23. Select “MODBUSRTU” and then click “Add” button.



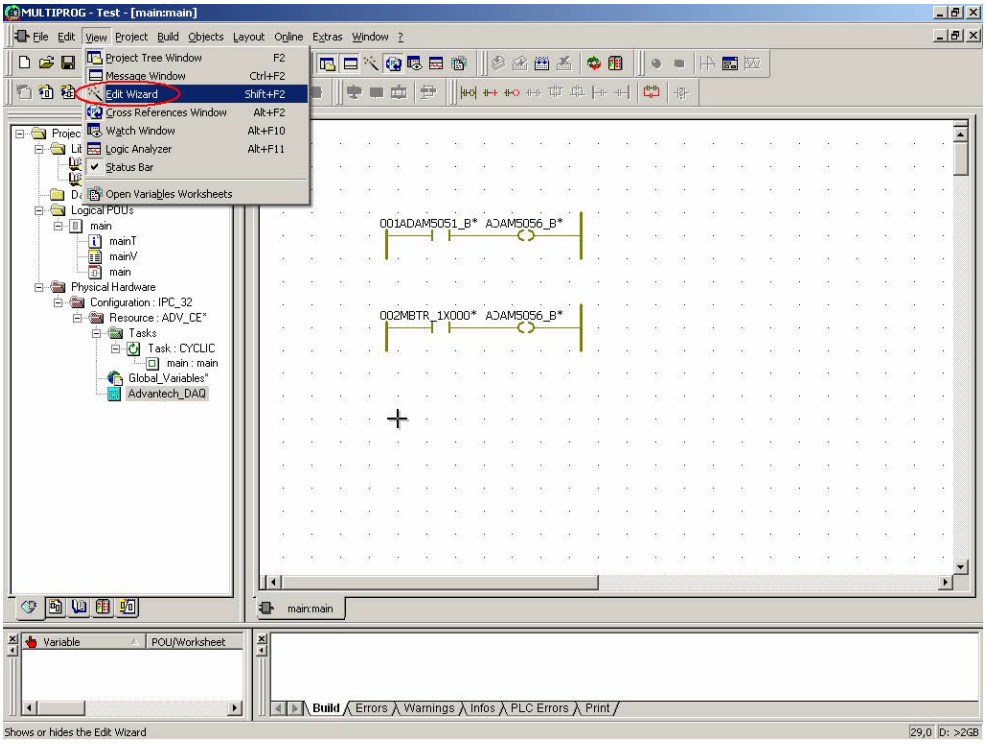
24. Set COM: “COM4”, Modbus Command: “3X”, Slave ID: 1, Start Address: “1”, No. of points: 8, Data Type: “INT”.



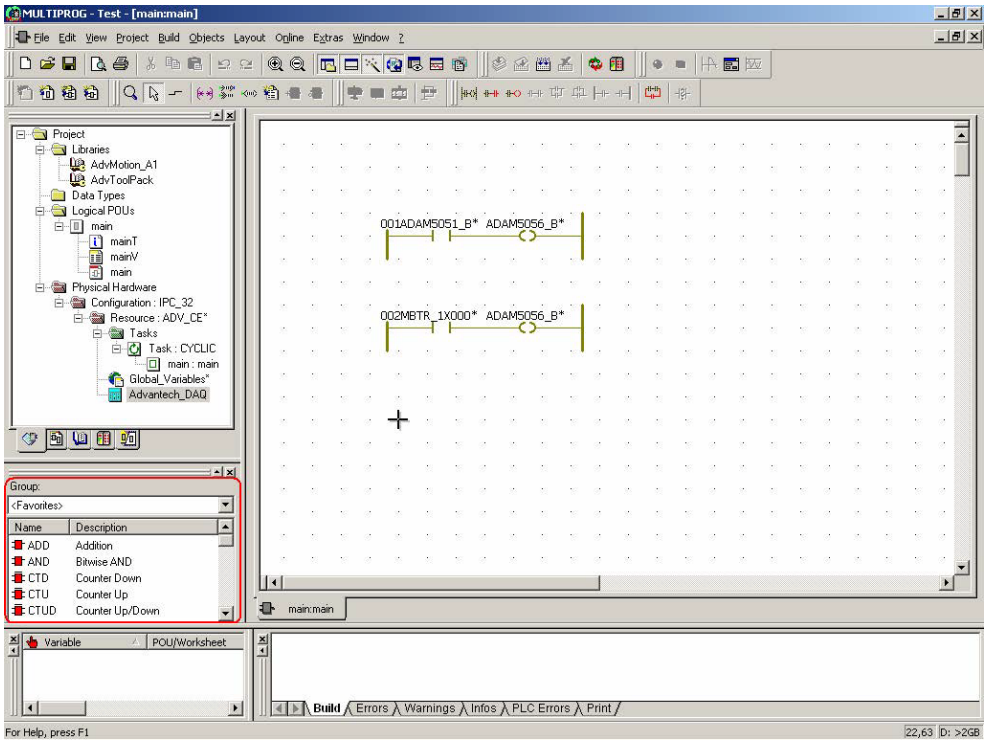
25. Click “Create All Input Variables” and then click “OK”.



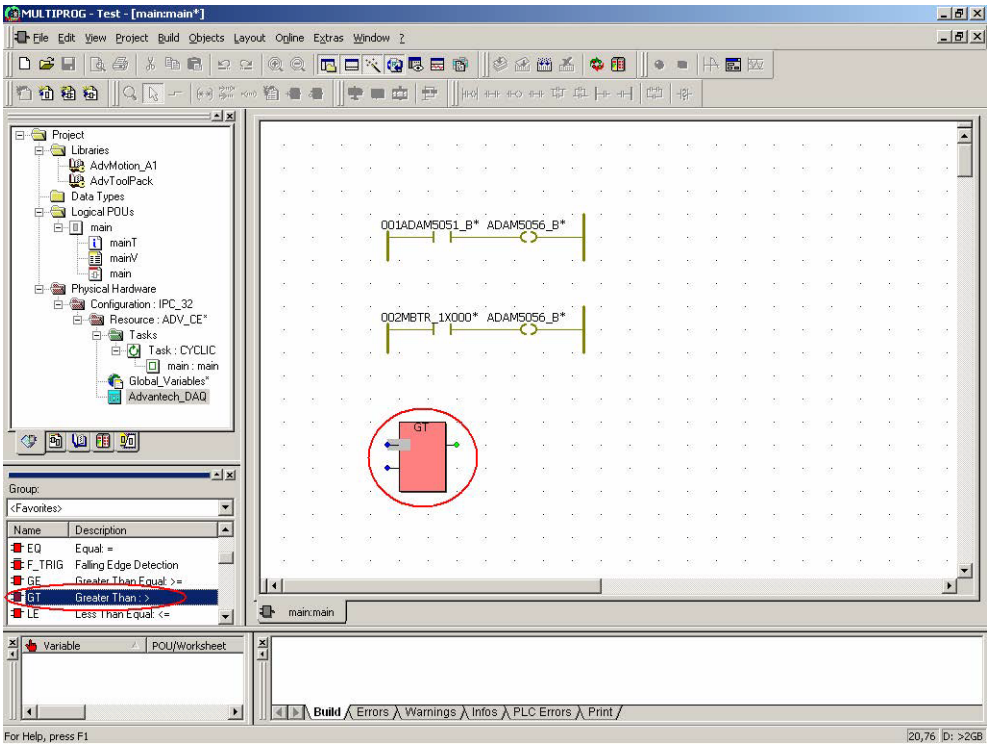
26. Click “Edit Wizard” to see the function blocks.



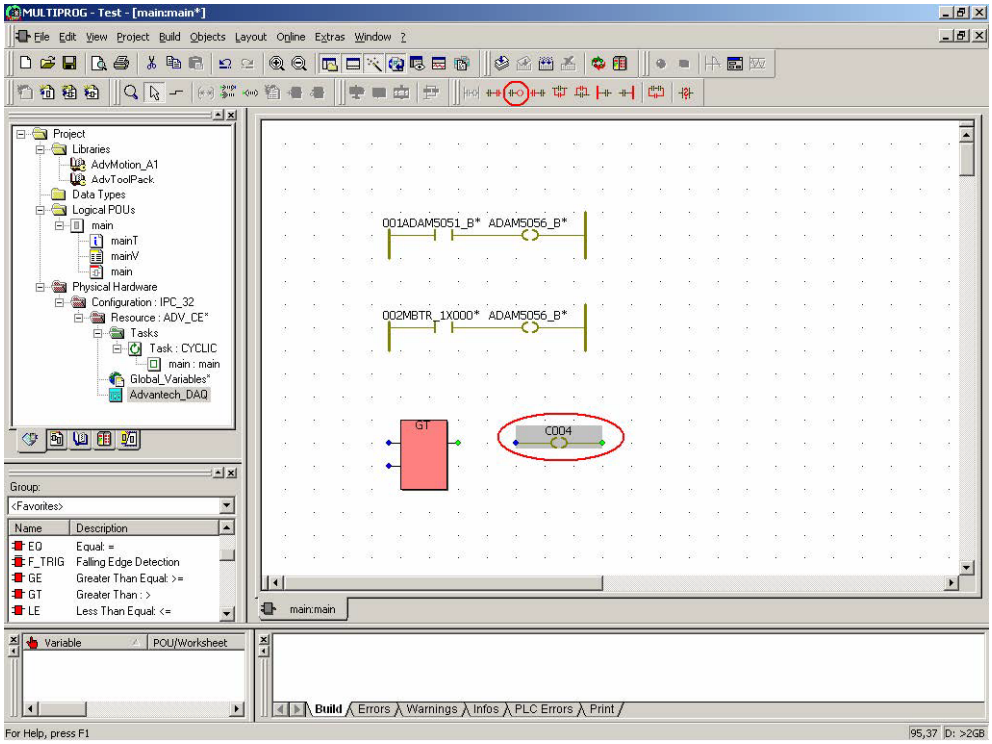
27. Find the “GT” Greater Than Function Block.



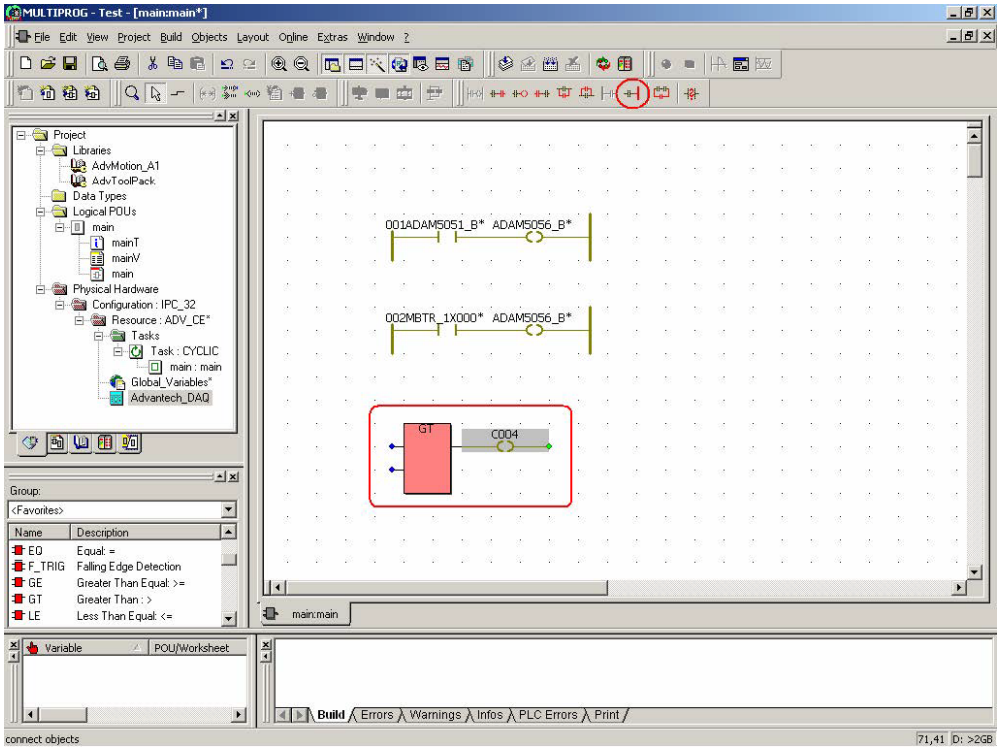
28. Add one “GT” function block.



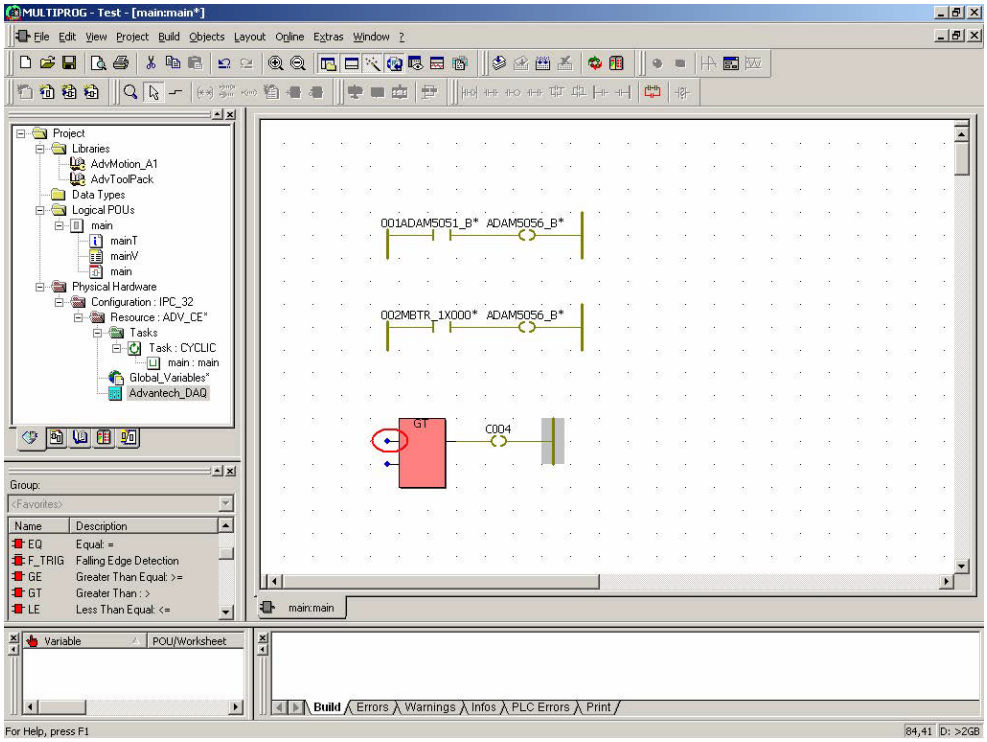
29. Add one coil by clicking “Add Coil Right” button.



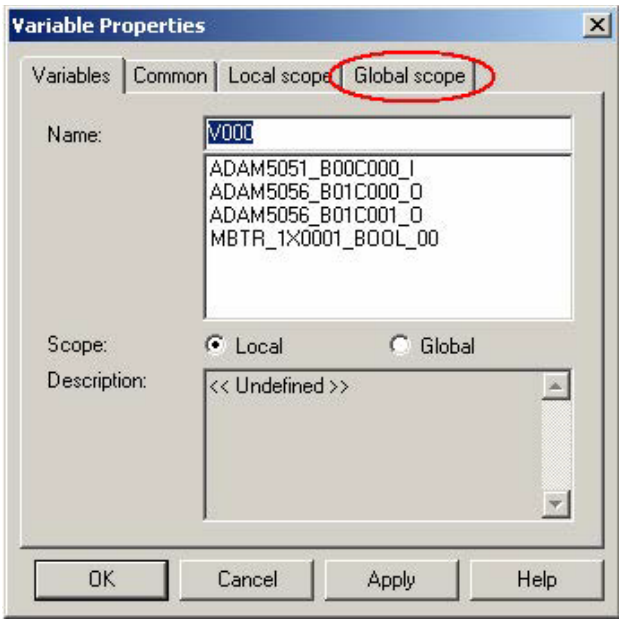
30. Connect “C004” coil to “GT” output.



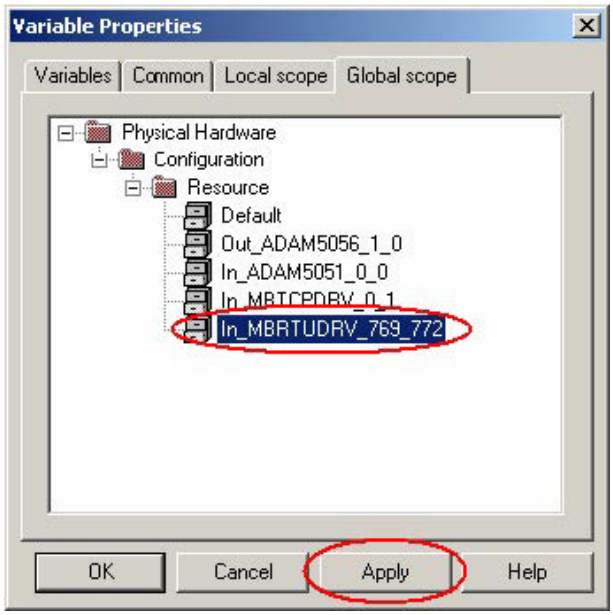
31. Double-click the first input of “GT” function block.



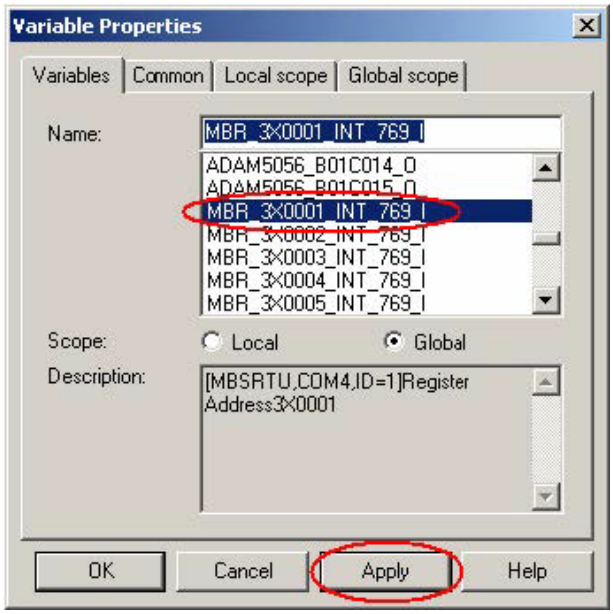
32. Select “Global scope” folder.



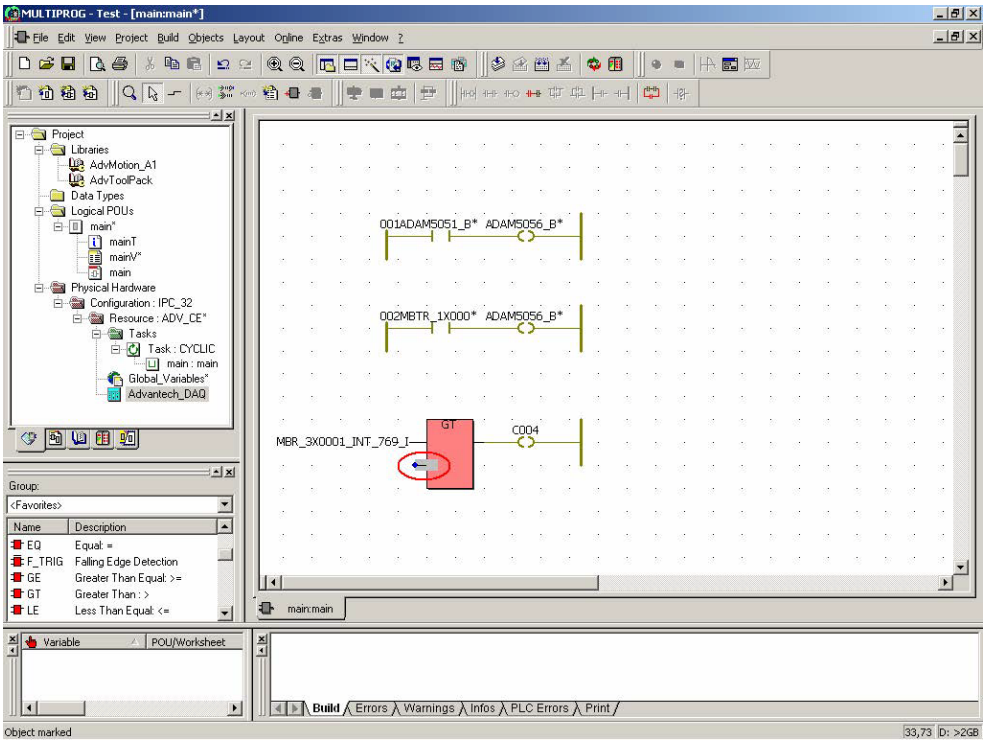
33. Select “In_MBRTUDRV_769_772” and then click “Apply”.



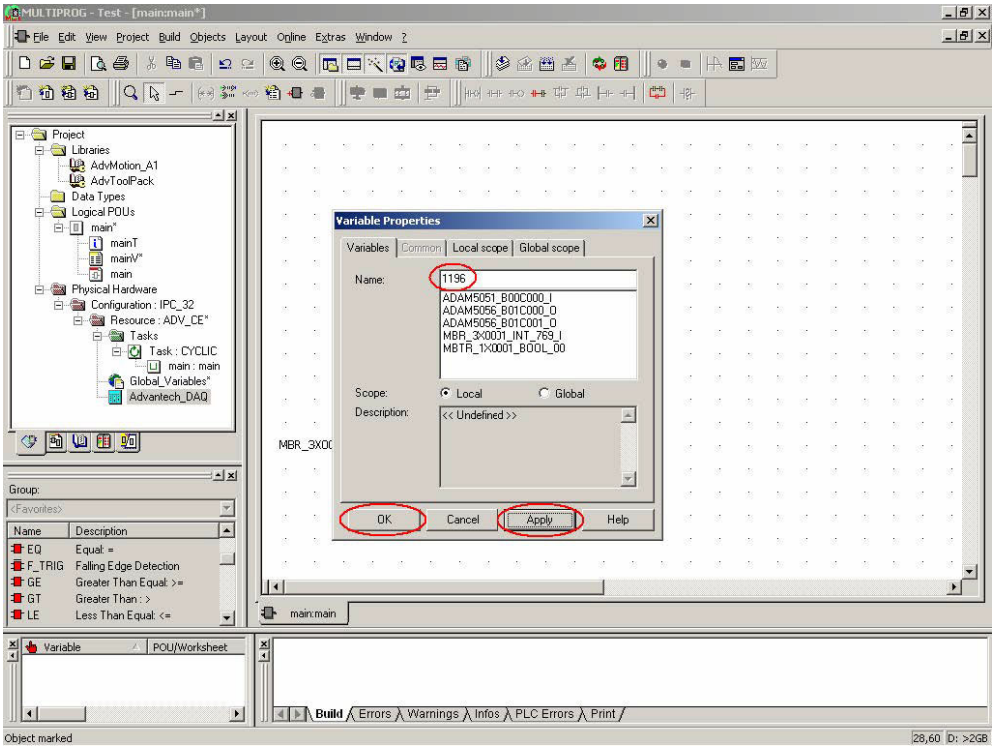
34. Select “MBR_3X0001_INT_769_I” to read CH0 of ADAM-4018+ module and then click “Apply”.



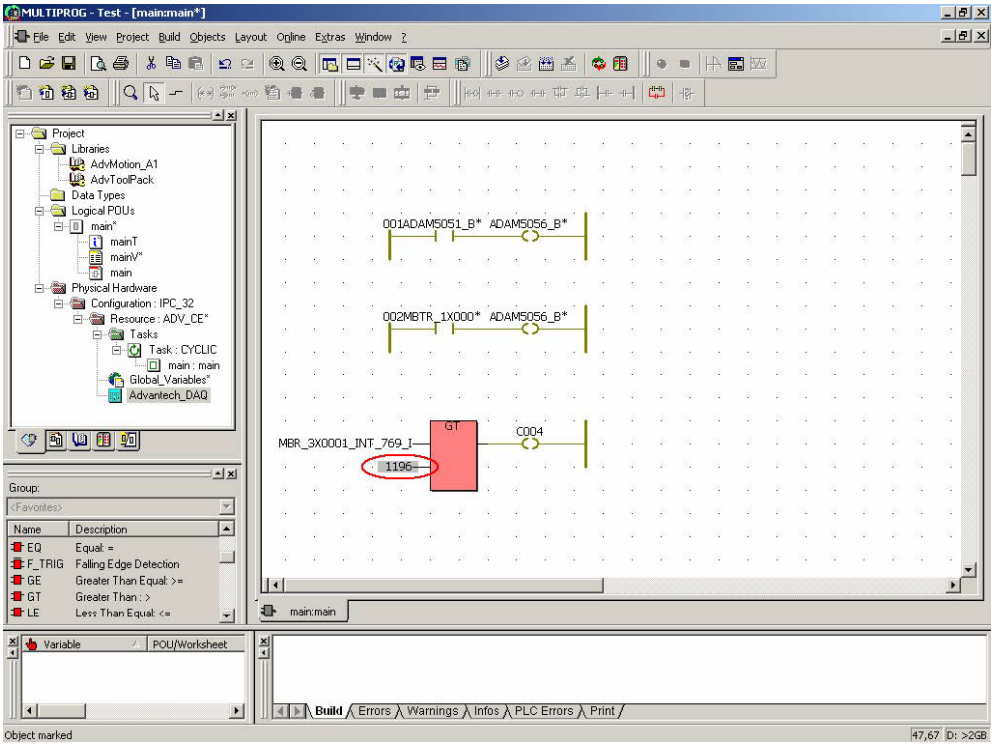
35. Double-click on the second input of “GT” function block.



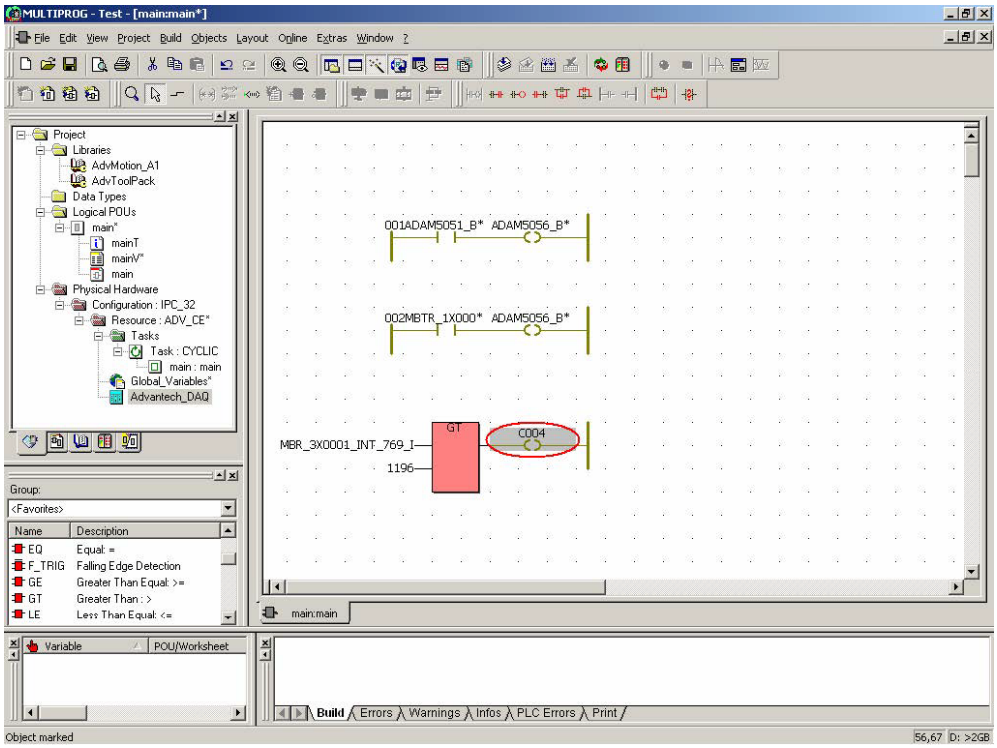
36. Type “1196” and then Click “Apply” and “OK”.



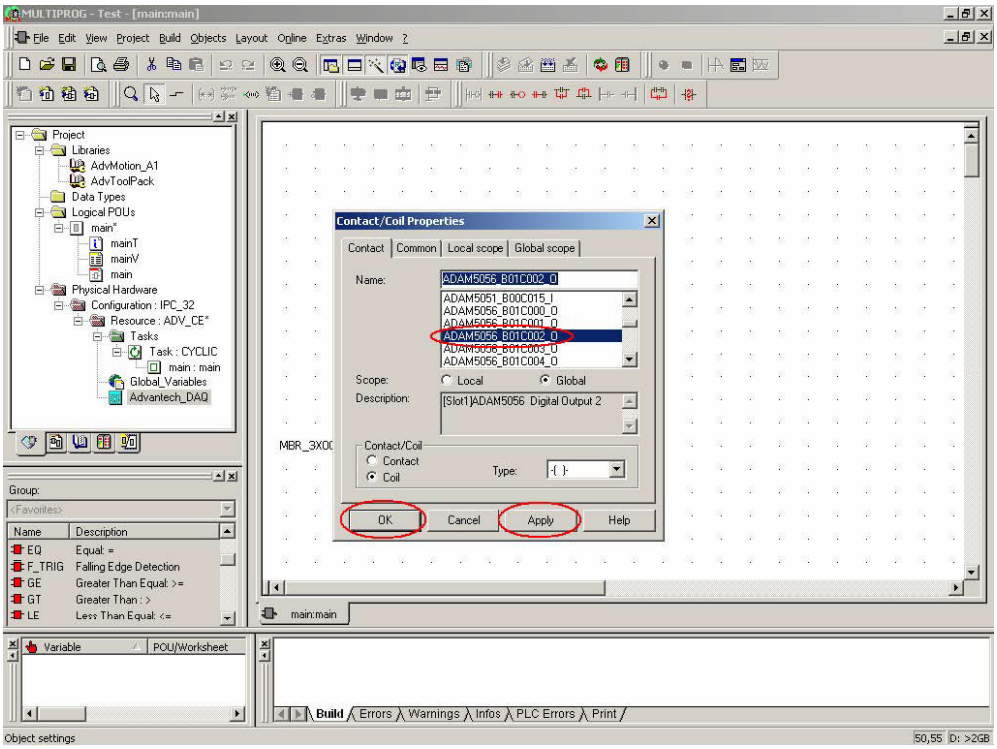
37. Check the setting “1196” is correct. (1196*1370)/65536 = 25ºC



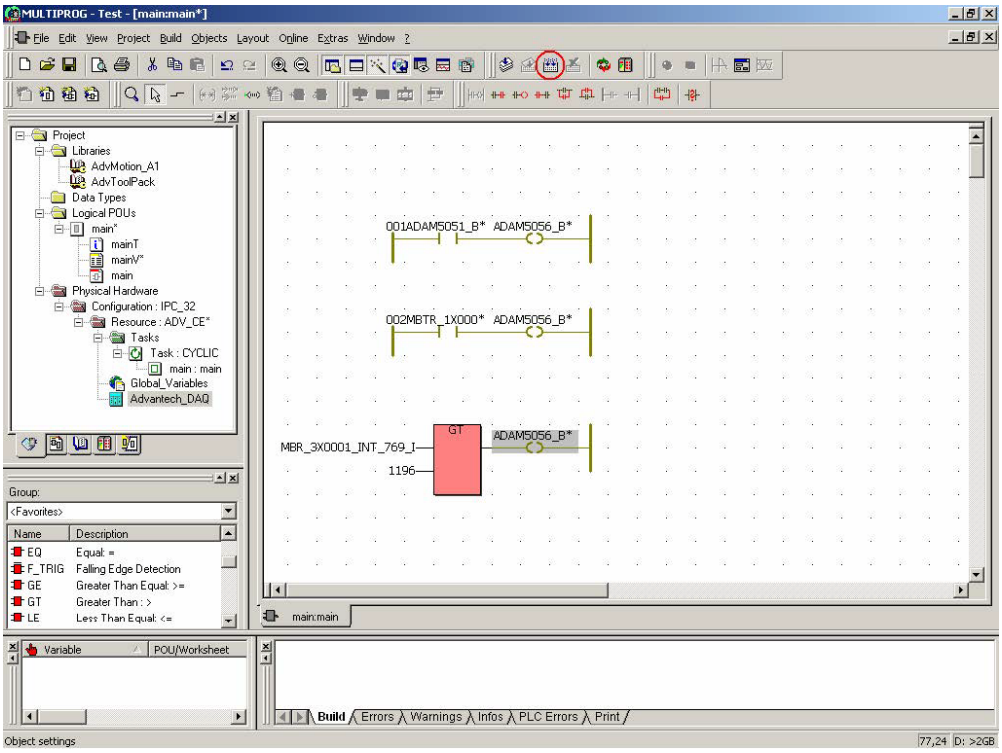
38. Double-click “C004”.



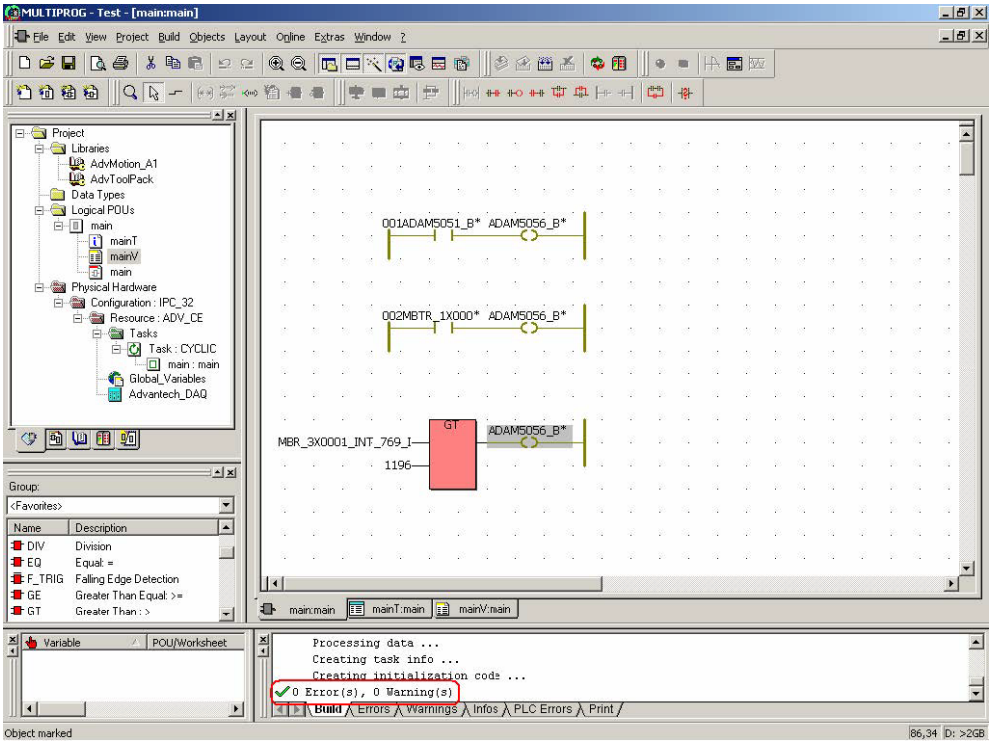
39. Select “ADAM5056_B01C002_O” to connect the “GT” function block output to ADAM-5056D DO bit 2. Click “Apply” and “OK”.



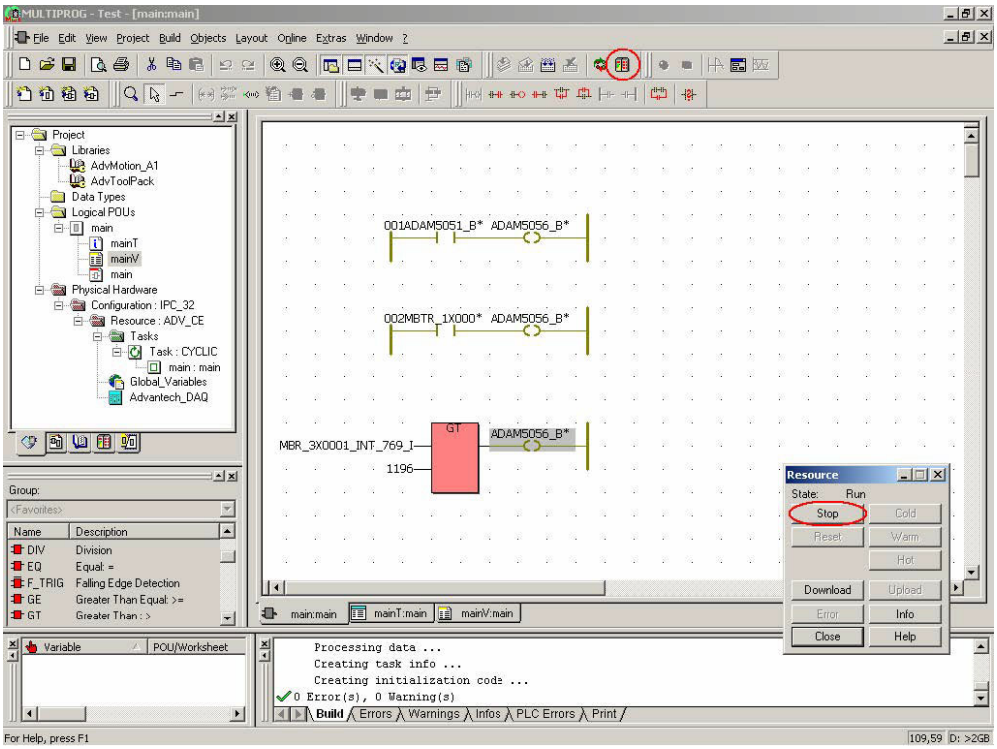
40. Click “Make” button to make the execution file.



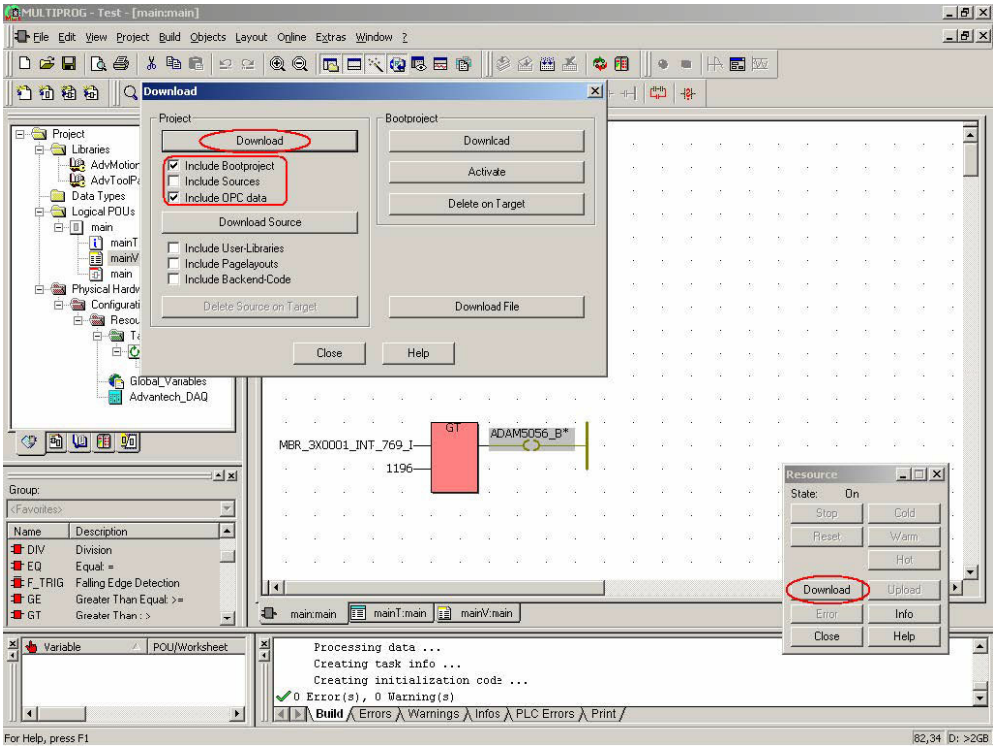
41. Check compile result is correct.



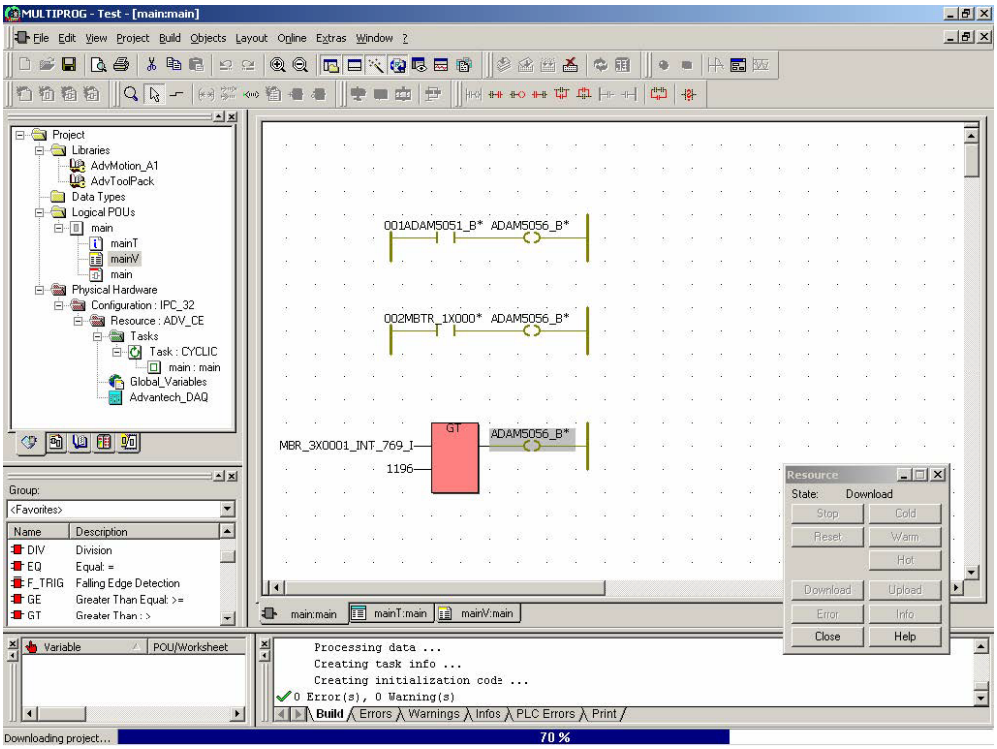
42. Click “Project Control Dialog” button and then click “Stop” and “Reset”.



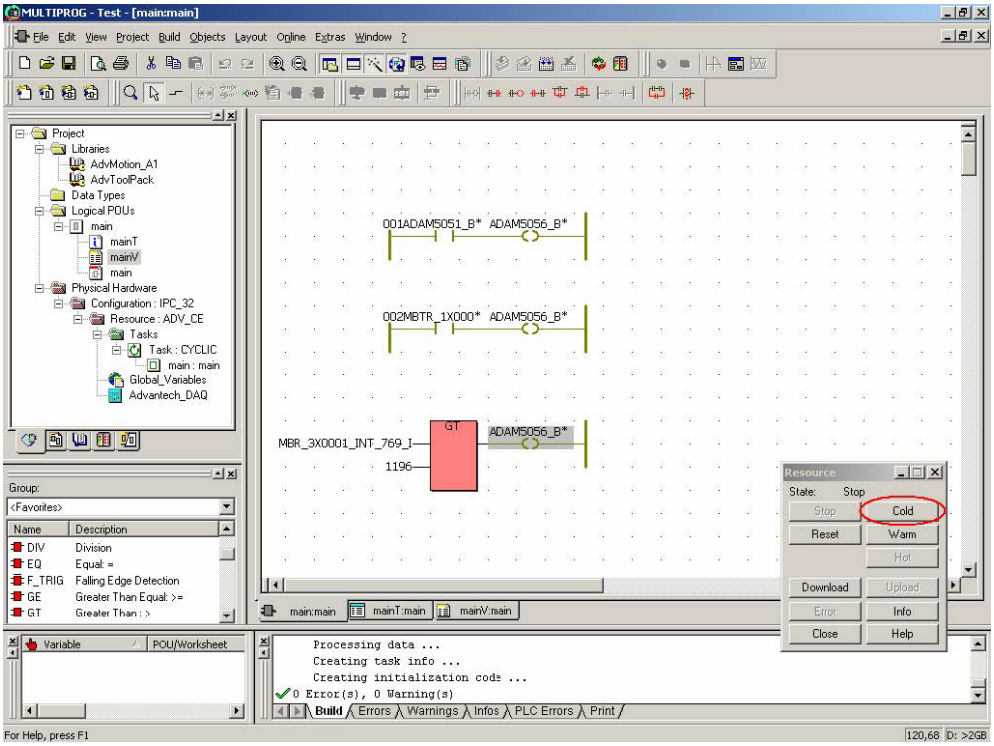
43. Click “Download” button. Check the “Include bootproject” item and then click “Download” to proceed with download process.



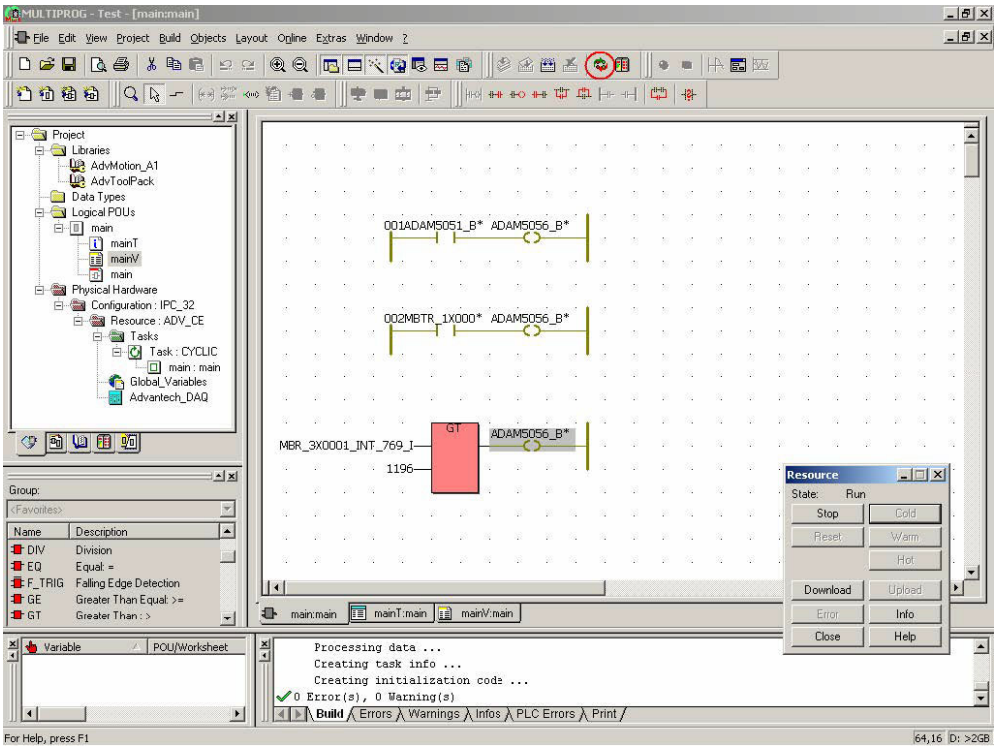
44. Project is downloading.



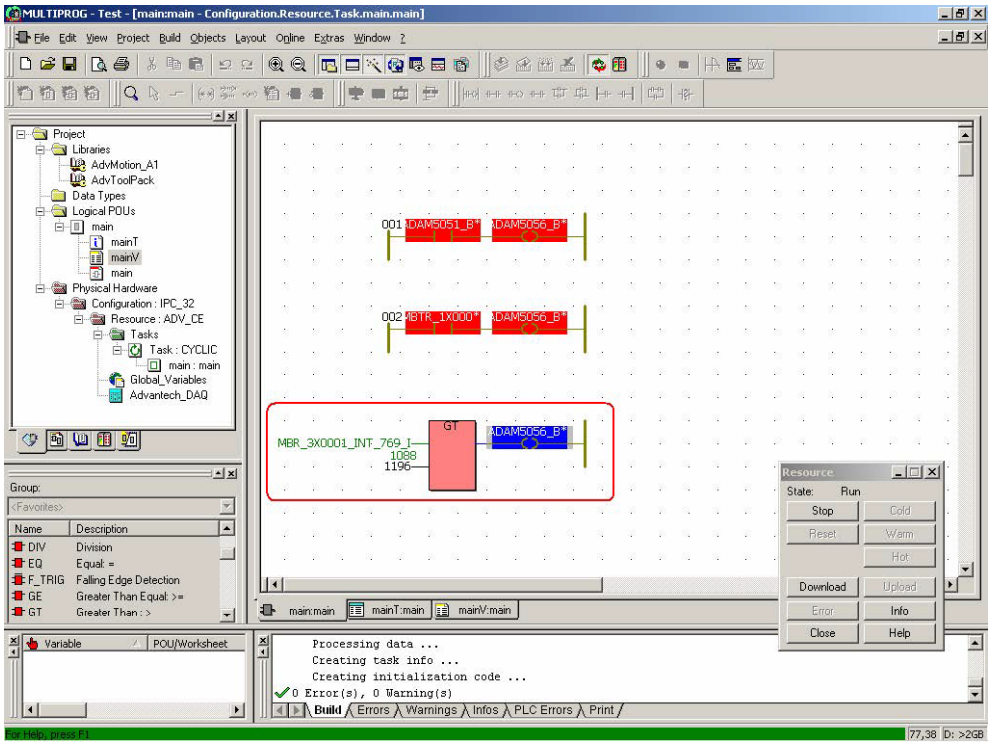
45. Click “Cold” button to run the project.



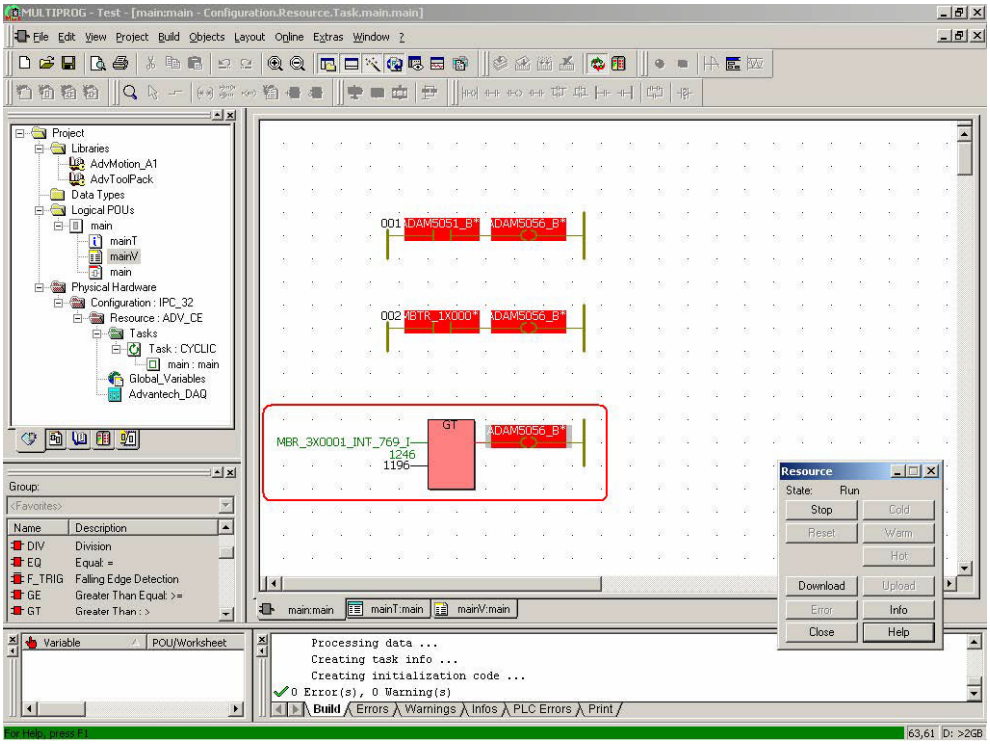
46. Click “Debug on/off” button.



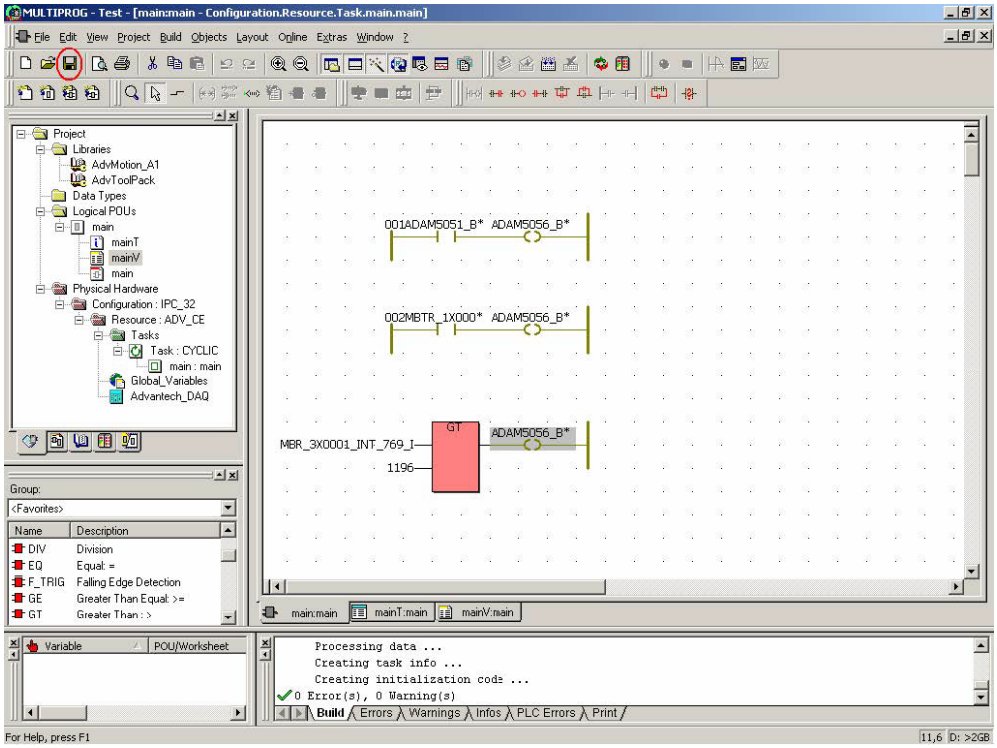
47. Check the reading of ADAM-4018+ CH0 is “1088” which is less than “1196”. The ADAM-5056D DO CH2 is OFF.



48. Heating the thermocouple of ADAM-4018+ CH0. When the reading is greater than “1196”, the ADAM-5056D DO CH2 will turn ON.



49. Save the project for following demonstration.



4.4 Modbus/TCP Server Functions

ADAM-5560 Series Controller supports Modbus/TCP server function for connecting to HMI/SCADA software. The Modbus/TCP server function is supported by using Ethernet port of ADAM-5560 Series Controller.

4.4.1 Modbus Address Mapping

ADAM-5560 Series Controller reserves 16K Bytes memory space for Modbus function. The memory block can store user's data and exchange it through Modbus protocol. The unit in Modbus 4X registers is Word so there are totally 8K Words available.

The Modbus address is defined from 42001 to 49999. In order to exchange the data through Modbus, users need to move the data onto this memory block by setting the memory address in "I/O Address" field manually. The memory address of this memory block is defined from mw3.0 to mw3.15996. The mapping table of I/O Address and Modbus Address is as following table.

I/O Address	Modbus Address
%mw3.0	42001
%mw3.2	42002
%mw3.4	42003
...	

Since unit of mw3.0 is Byte, users need to map the I/O Address and Modbus Address as following.

For Bool data type:

	I/O Address	Modbus Address	Length
Data 1	mw3.0.0	02001	1 Bit
Data 2	mw3.0.1	02002	1 Bit
Data 3	mw3.0.2	02003	1 Bit

For Byte and Word data type:

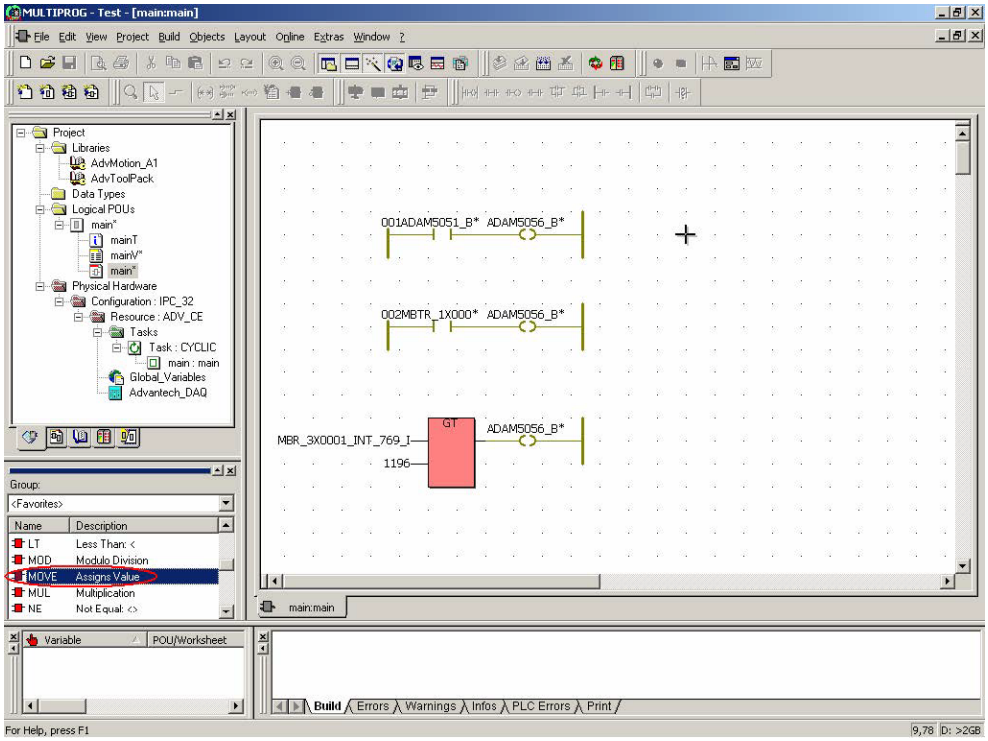
	I/O Address	Modbus Address	Length
Data 1	mw3.0+ mw3.1	42001	2 Bytes
Data 2	mw3.2+mw3.3	42002	2 Bytes
Data 3	mw3.4+mw3.5	42003	2 Bytes

For Dword and Real data type:

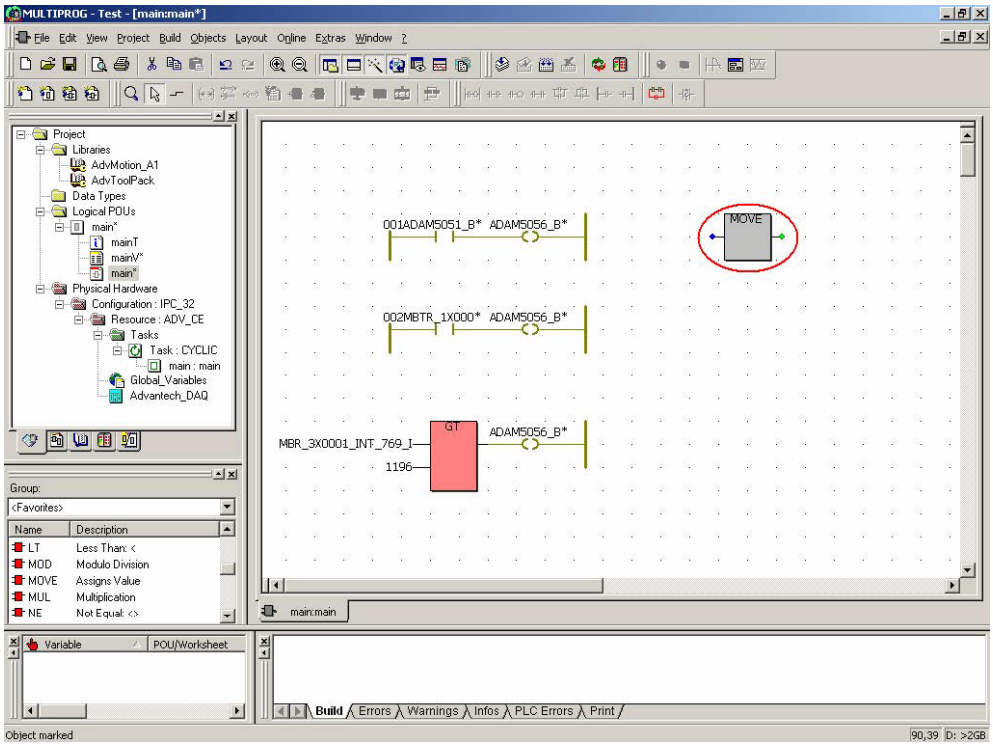
	I/O Address	Modbus Address	Length
Data 1	mw3.0+mw3.1+mw3.2+mw3.3	42001+42002	4 Bytes
Data 2	mw3.4+mw3.5+mw3.6+mw3.7	42003+42004	4 Bytes
Data 3	mw3.8+mw3.9+mw3.10+mw3.11	42005+42006	4 Bytes

4.4.2 Example

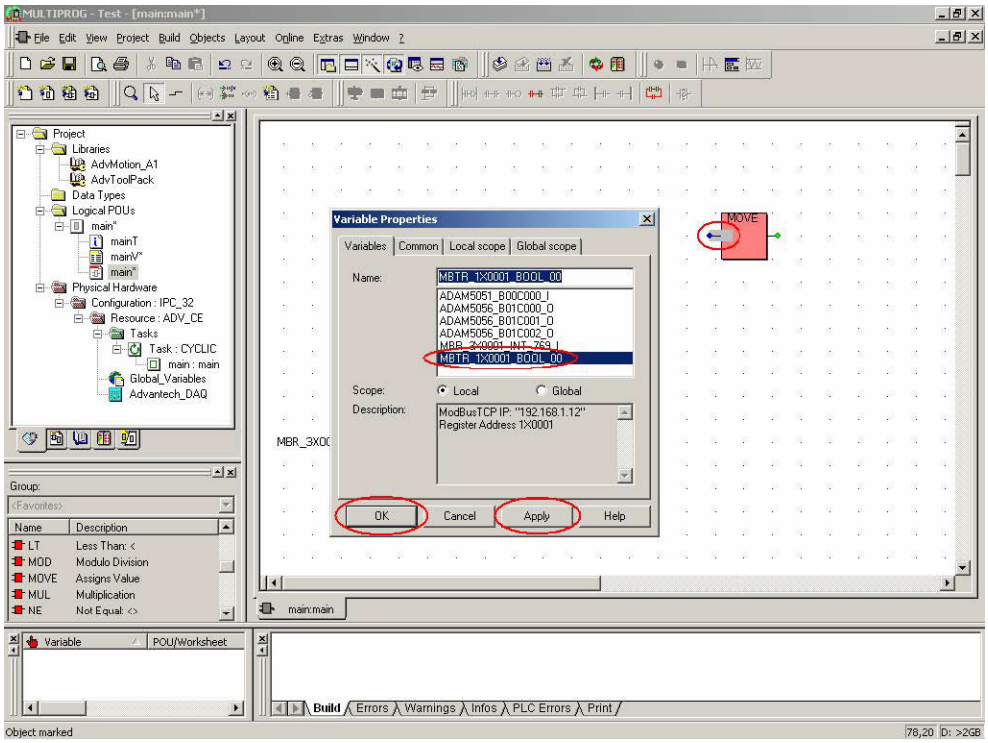
1. Open the “Test.mwt” and add one “Move” function block.



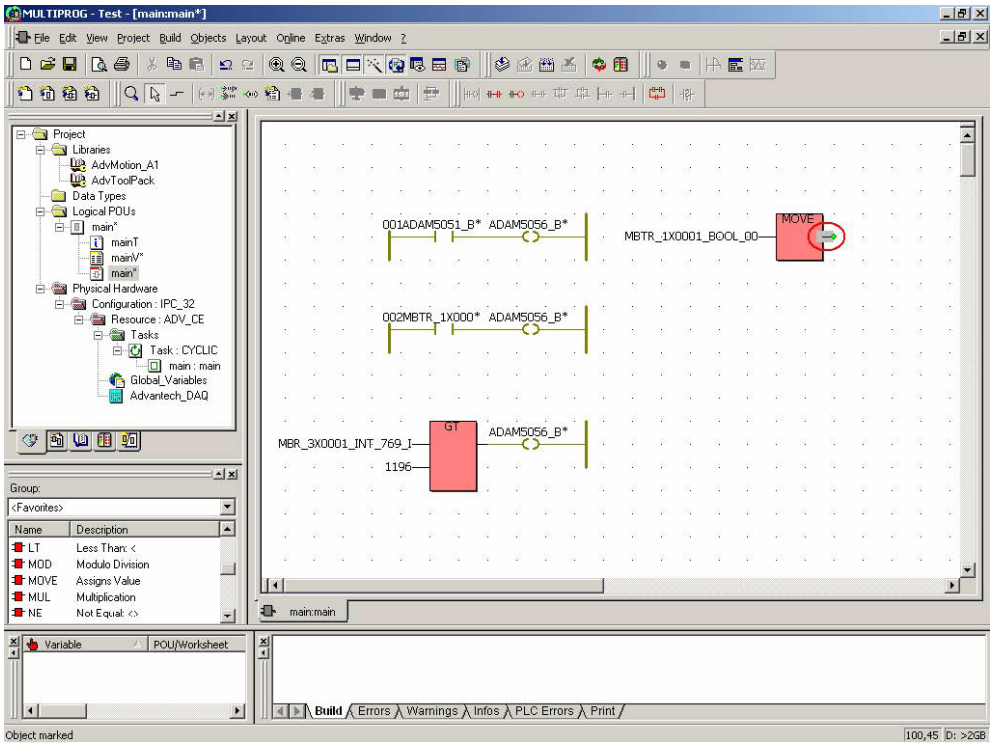
2. “Move” function block will be shown on graphical editor.



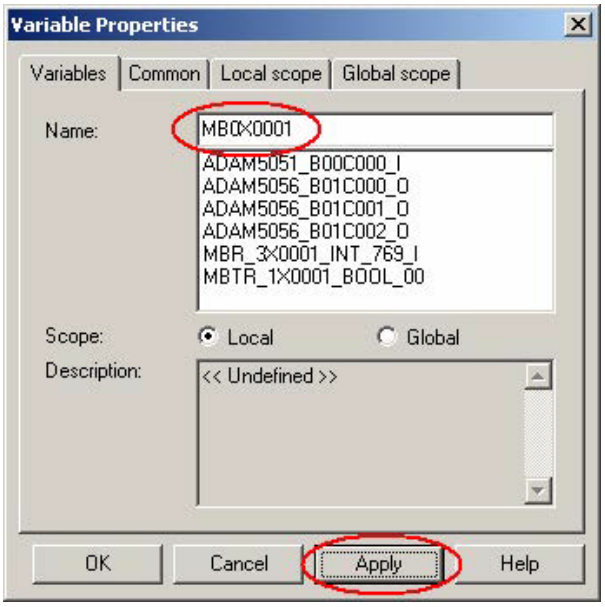
3. Double-click the input of “Move” function block. Select “MBTR_1X0001_BOOL_00” (ADAM-6050 DI bit 0) and then click “Apply” and “OK”.



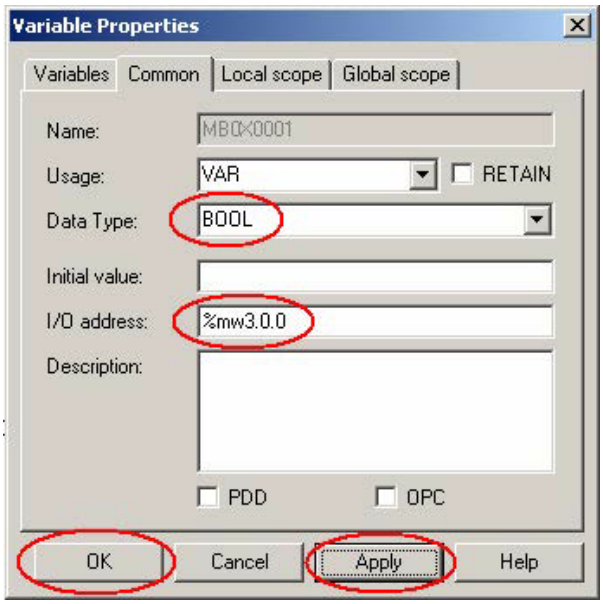
4. Double-click output of “Move” function block.



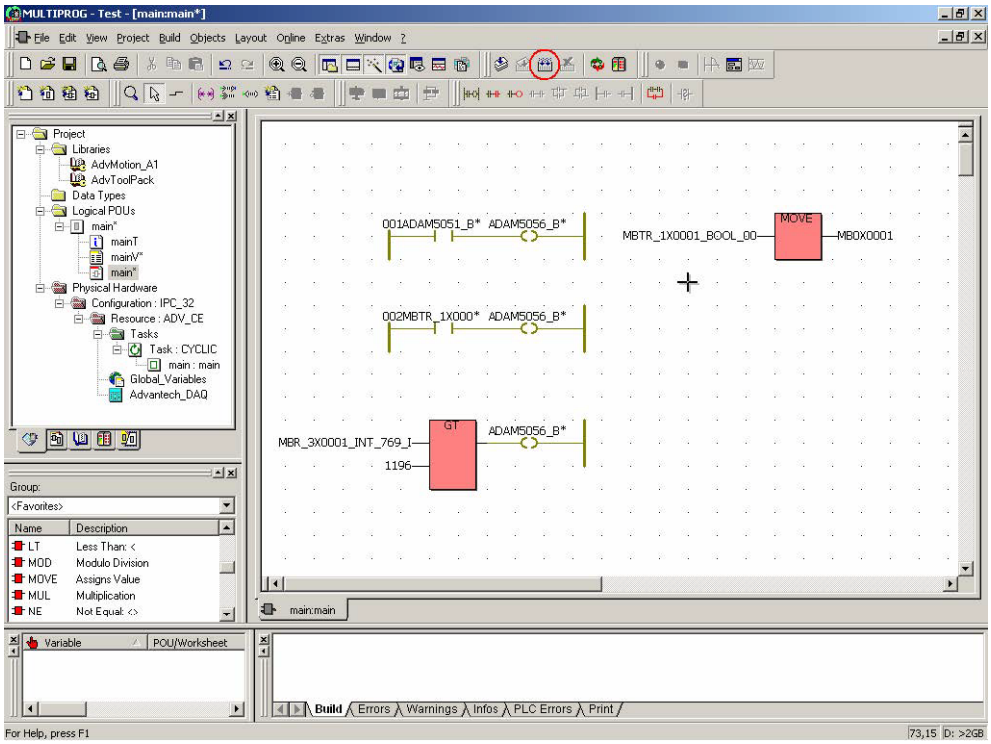
5. Type “MB0X0001” and click “Apply” button.



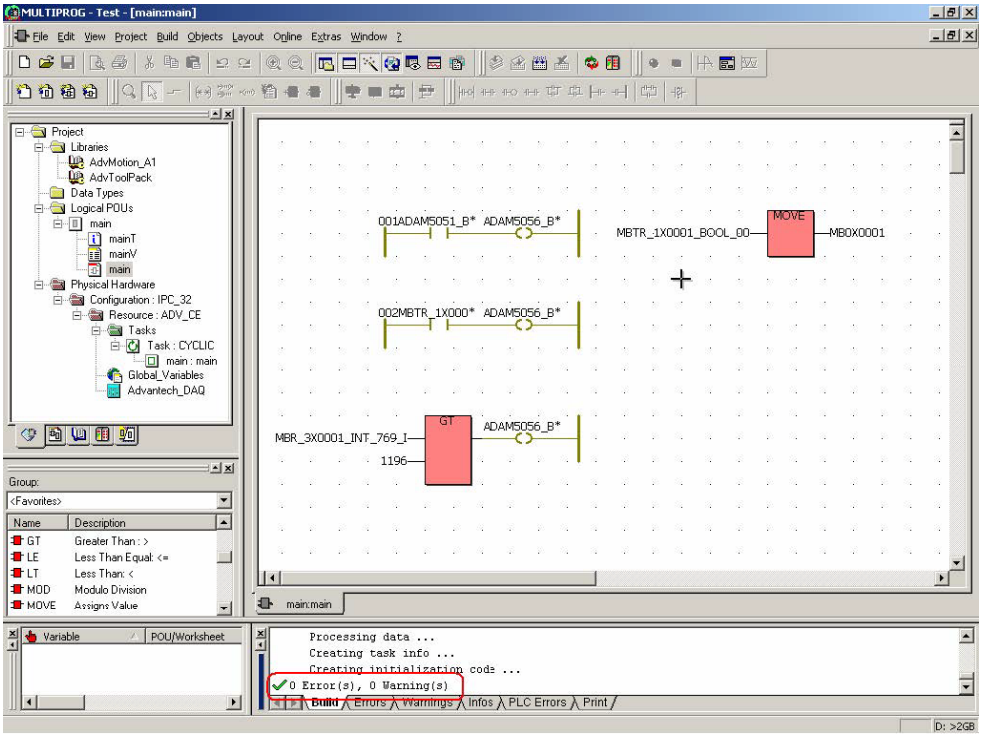
6. Select “BOOL” for Data Type. Type “%mw3.0.0” for “I/O address” and then click “Apply” and “OK”.



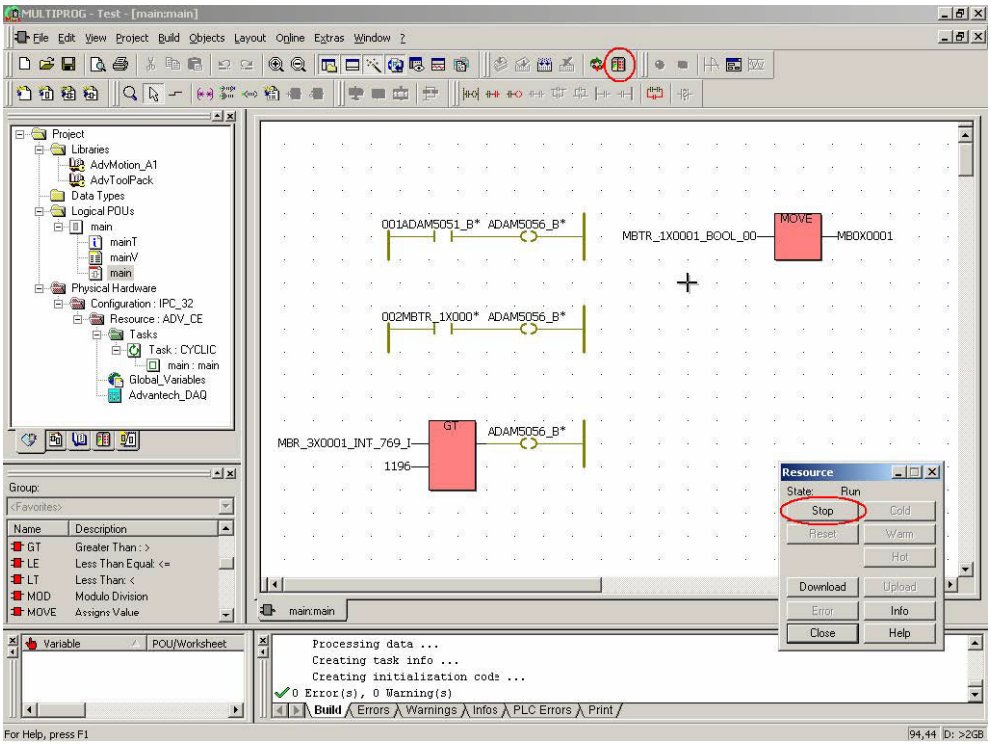
7. Click “Make” button to make the execution file.



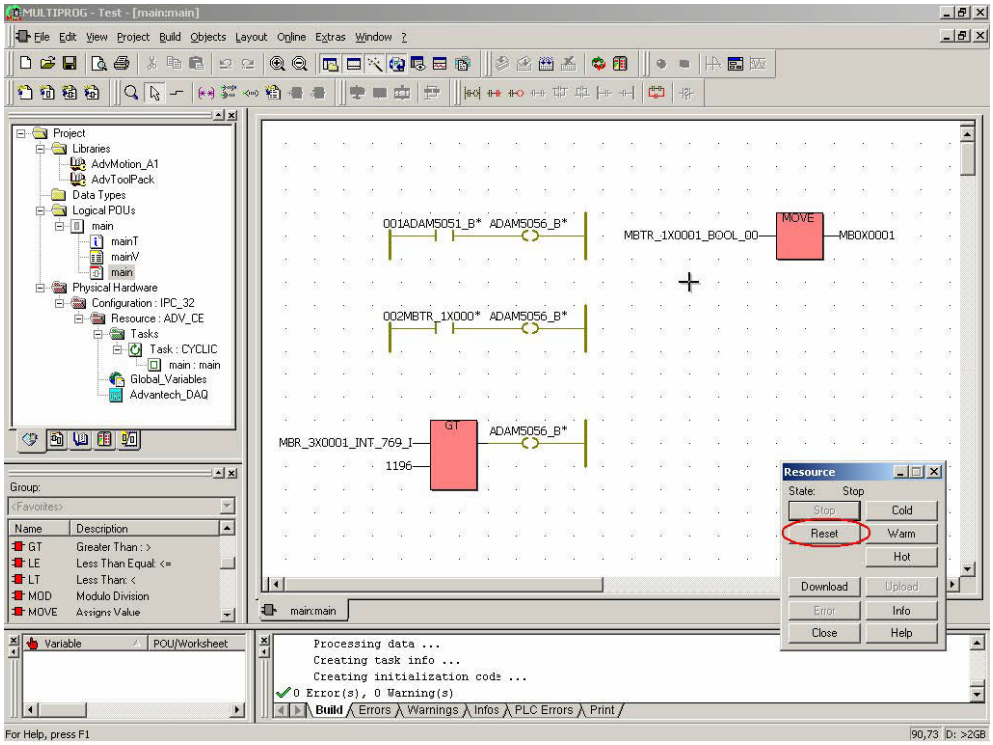
8. Check compile result is correct.



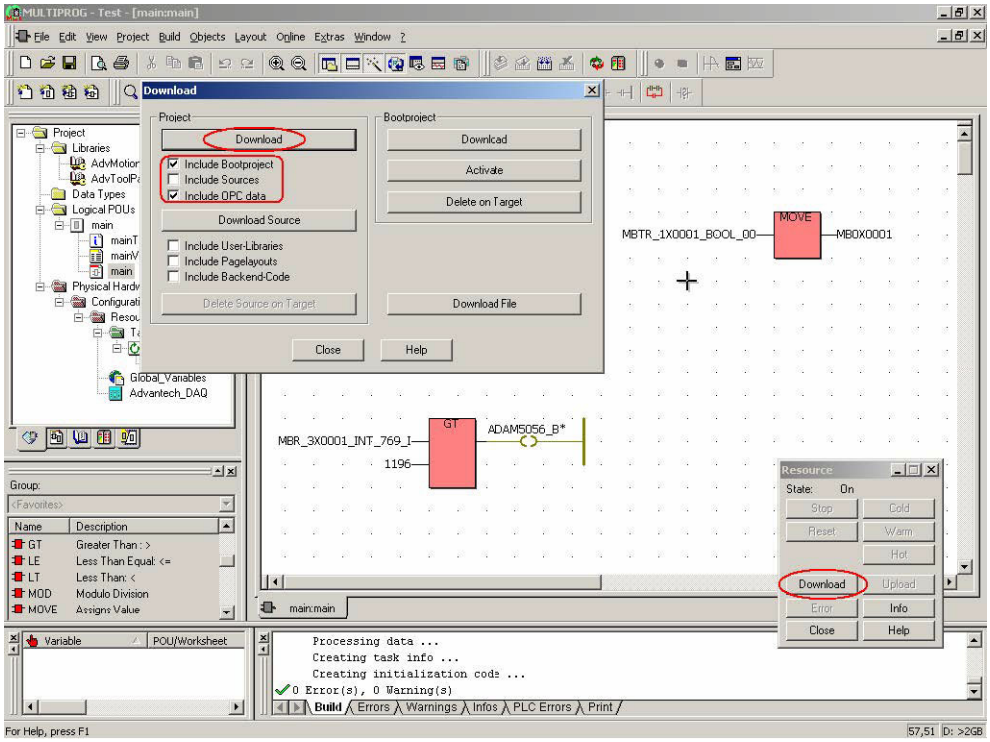
9. Click “Project Control Dialog” button and then click “Stop”.



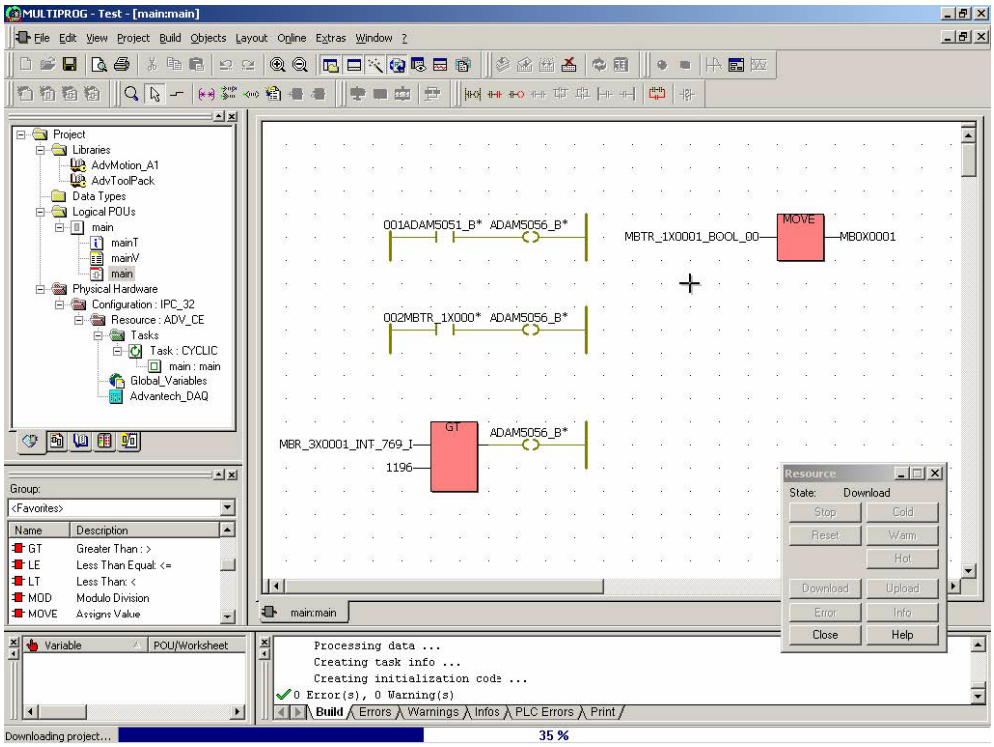
10. Click “Reset” button.



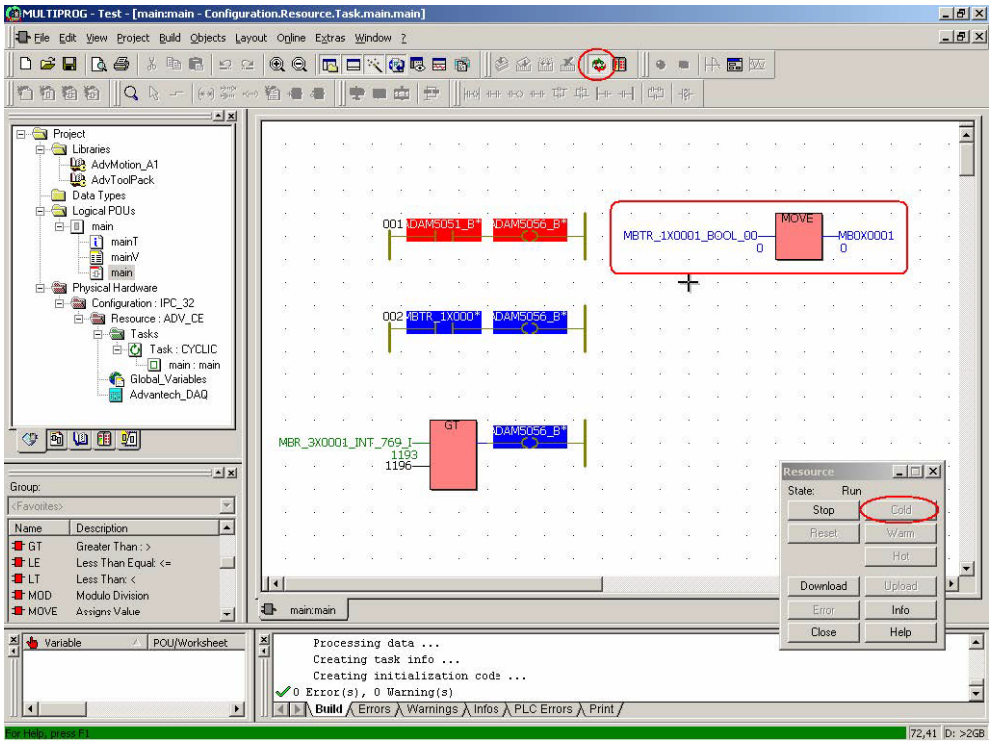
11. Click “Download” button. Check the “Include bootproject” item and then click “Download” to proceed with download process.



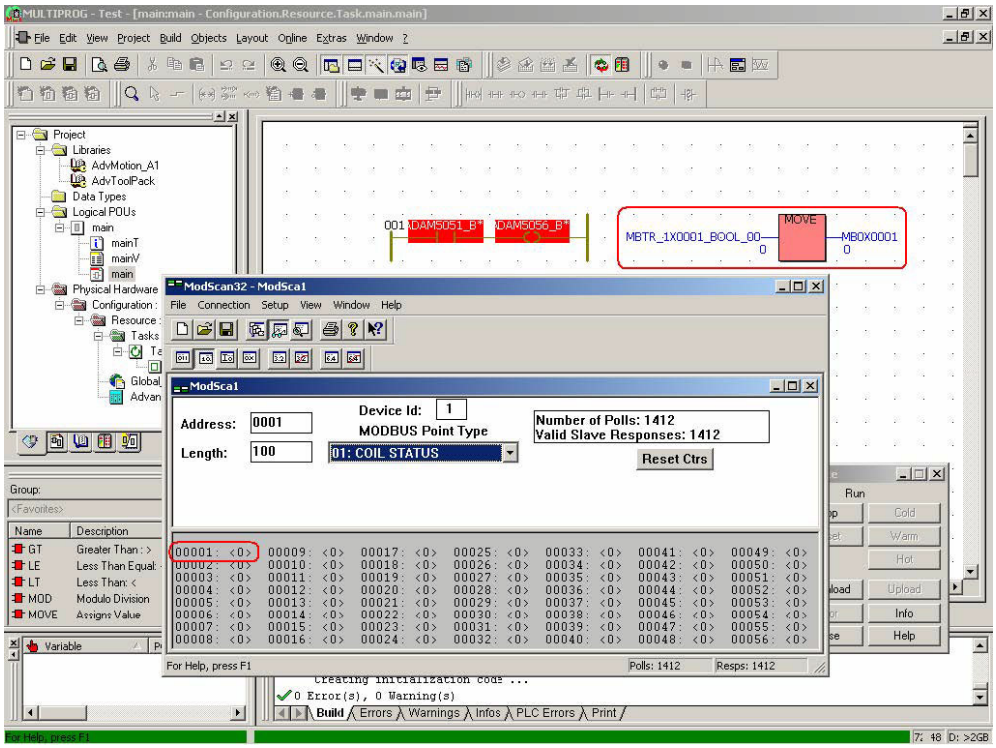
12. Project is downloading.



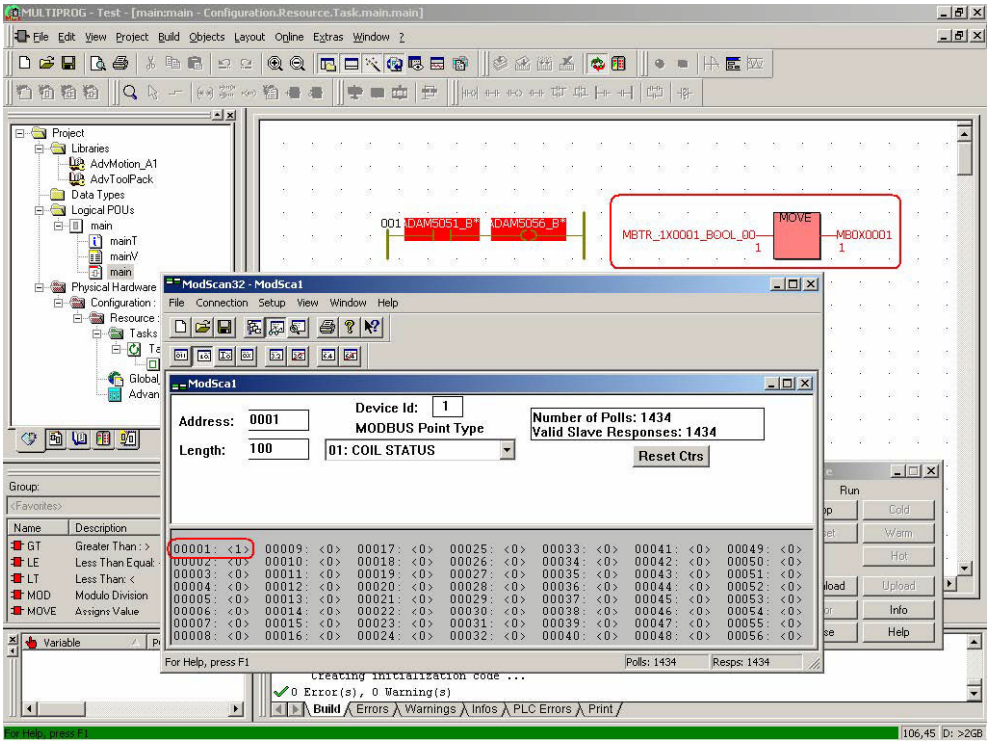
13. Click “Cold” to run the project. Click “Debug on/off” button to see the result.



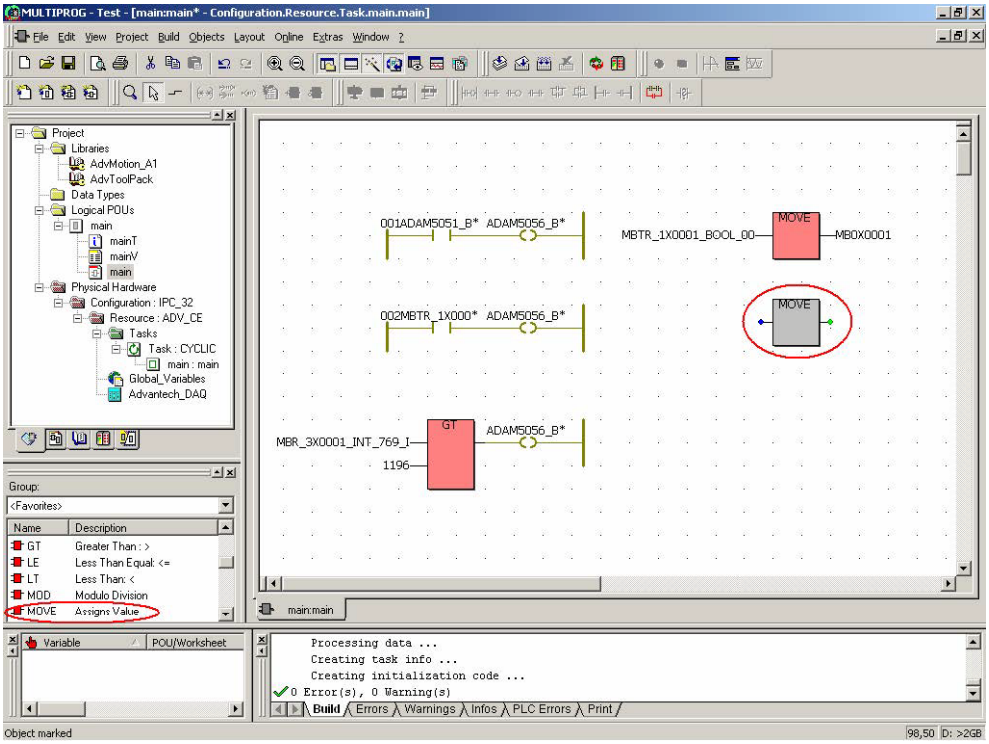
14. Run Modbus/TCP Client utility Modscan and check the value of I/O address mw3.0.0 and Modscan I/O address 00001 are the same.



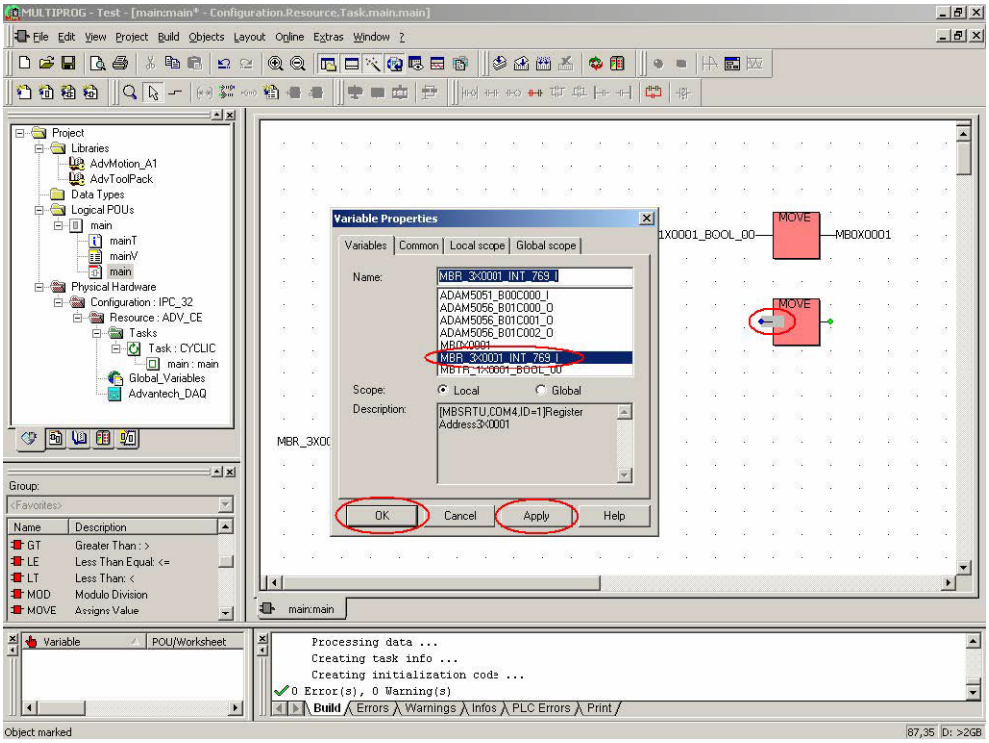
15. Change the status of ADAM-6050 DI bit 0 to “1”. Check the values of I/O address mw3.0.0 and Modscan I/O address 00001 are all changed to “1”.



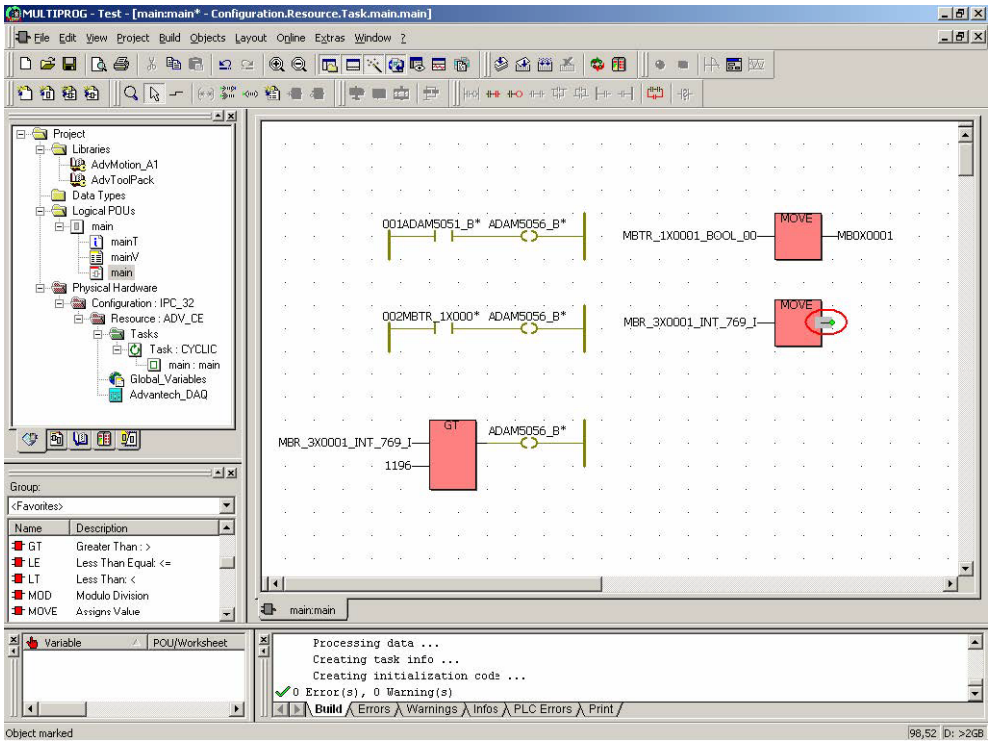
16. Add one more “Move” function block for analog measurement.



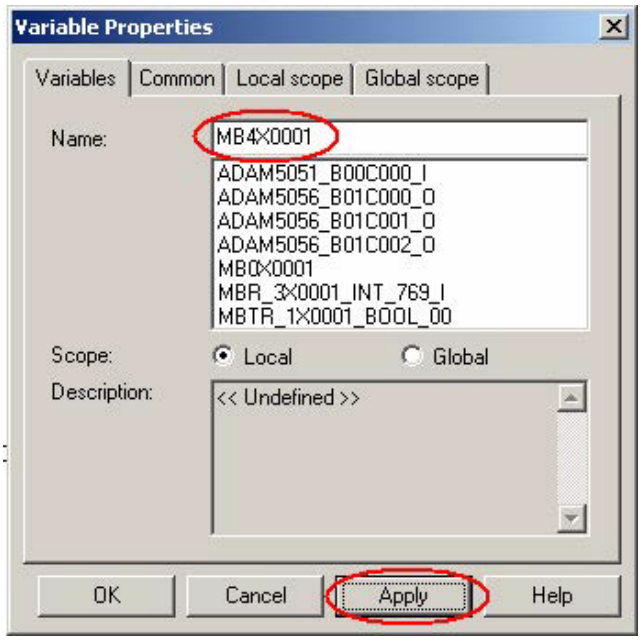
17. Double-click the input of the 2nd “Move” function block. Select “MBR_3X0001_INT_769_I” (ADAM-4018+ CH0) and then click “Apply” and “OK”.



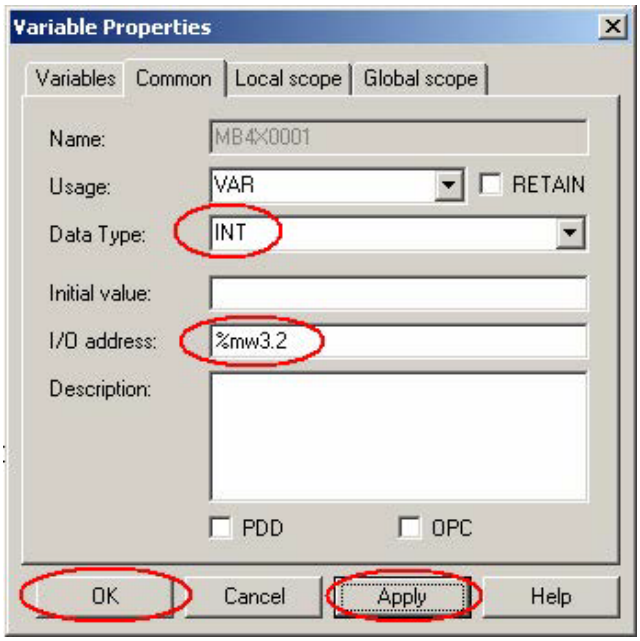
18. Double-click the output.



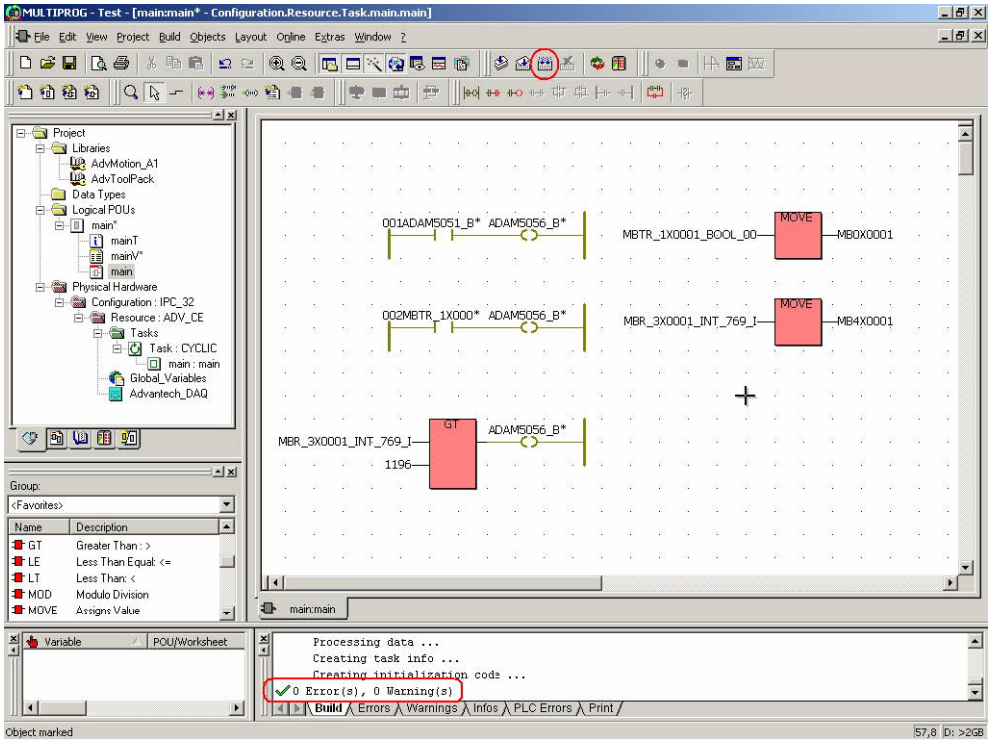
19. Type “MB4X0001” and then click “Apply”.



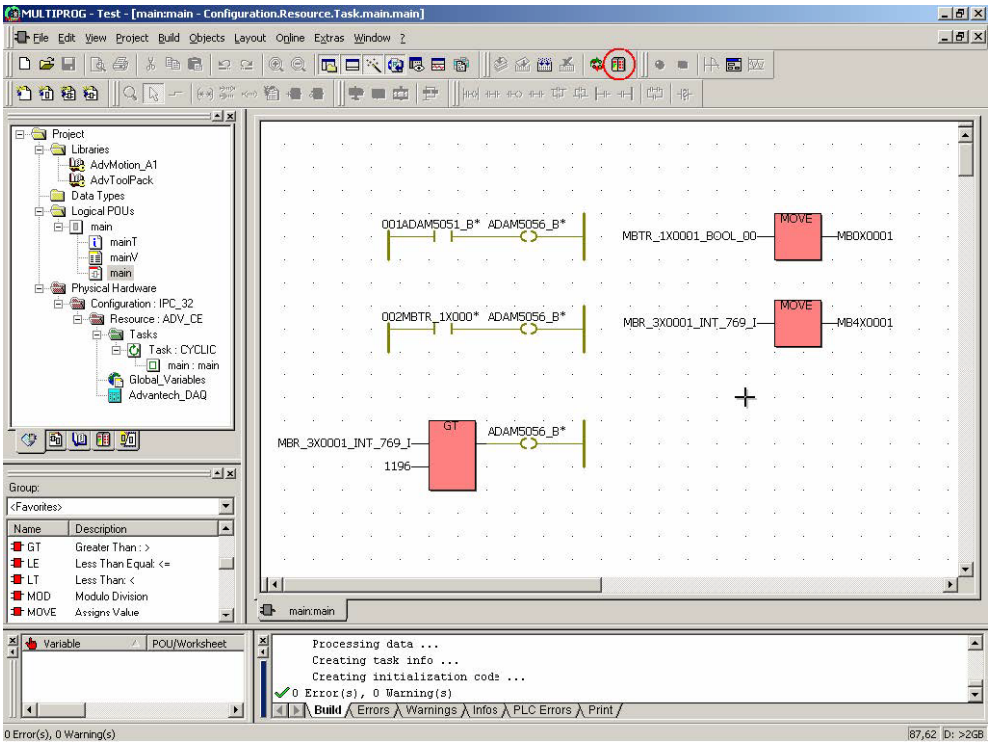
20. Select “INT” for Data Type. Type “%mw3.2” for “I/O address” and then click “Apply” and “OK”.



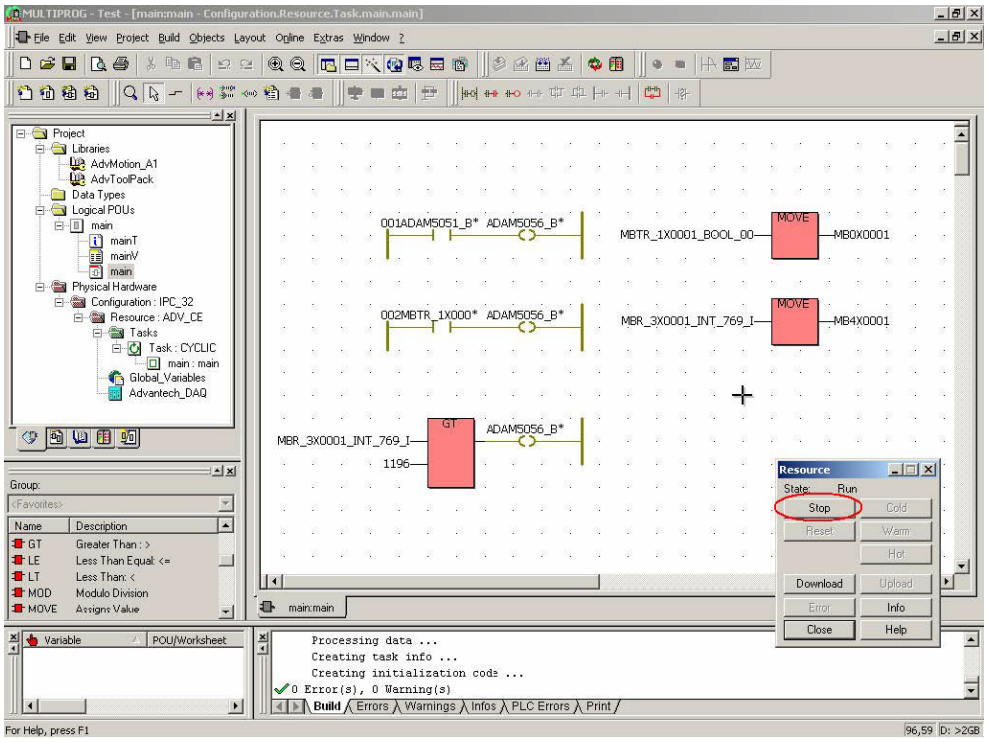
21. Click “Make” button to make the execution file and check the compile result is correct.



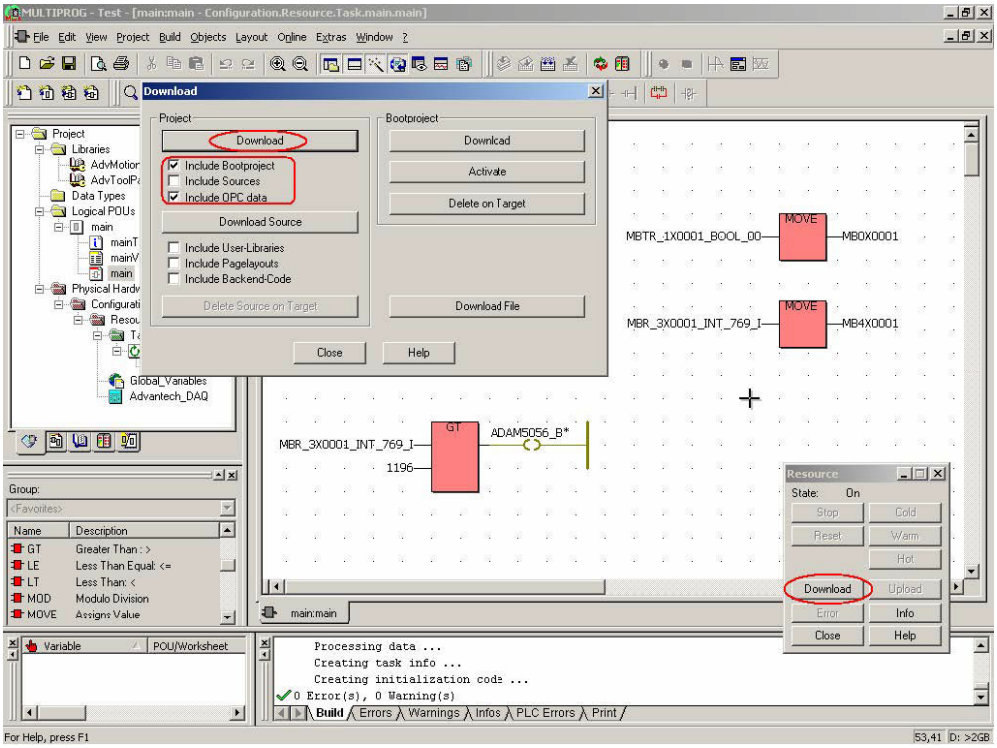
22. Click “Project Control Dialog” button.



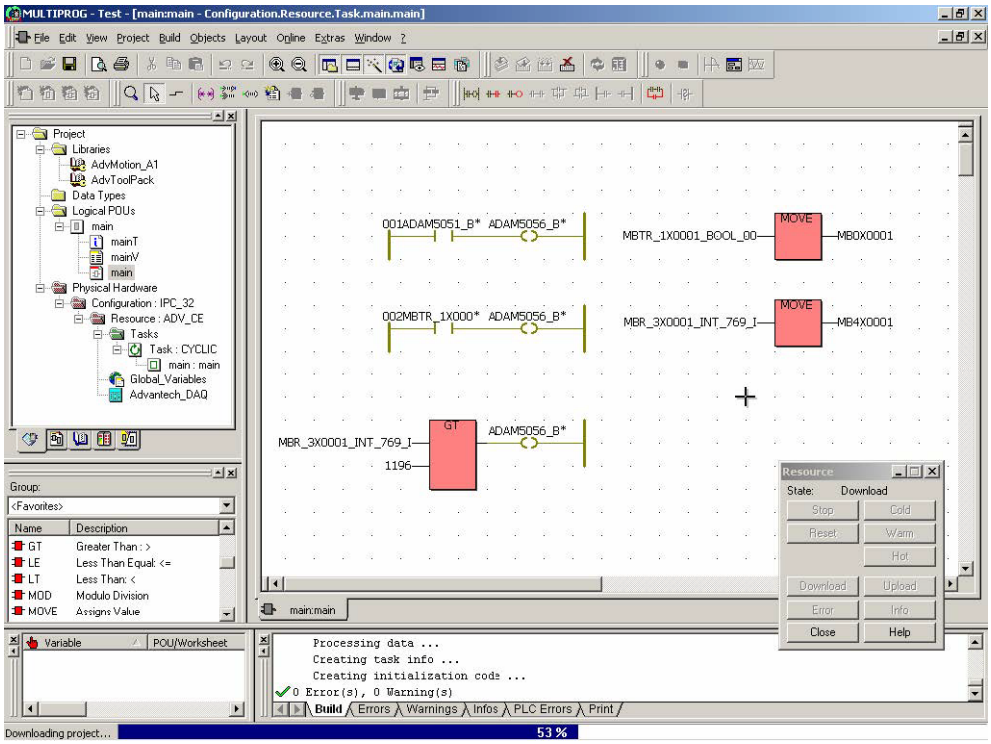
23. Click “Stop” and “Reset” button.



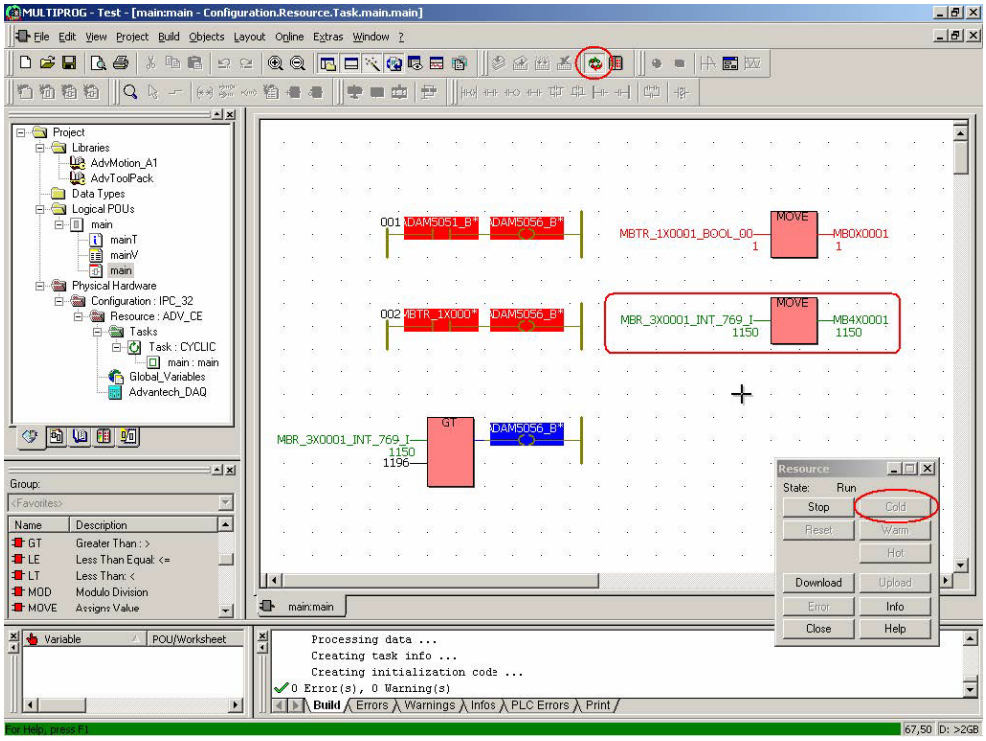
24. Click “Download” button. Check the “Include bootproject” item and then click “Download” to proceed with download process.



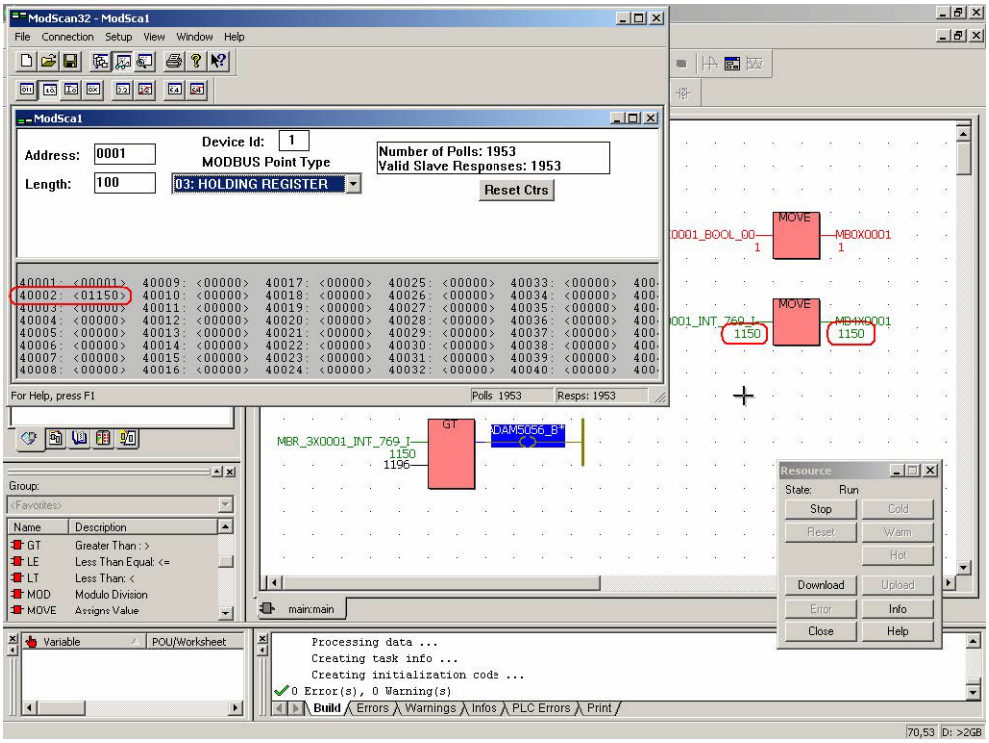
25. Project is downloading.



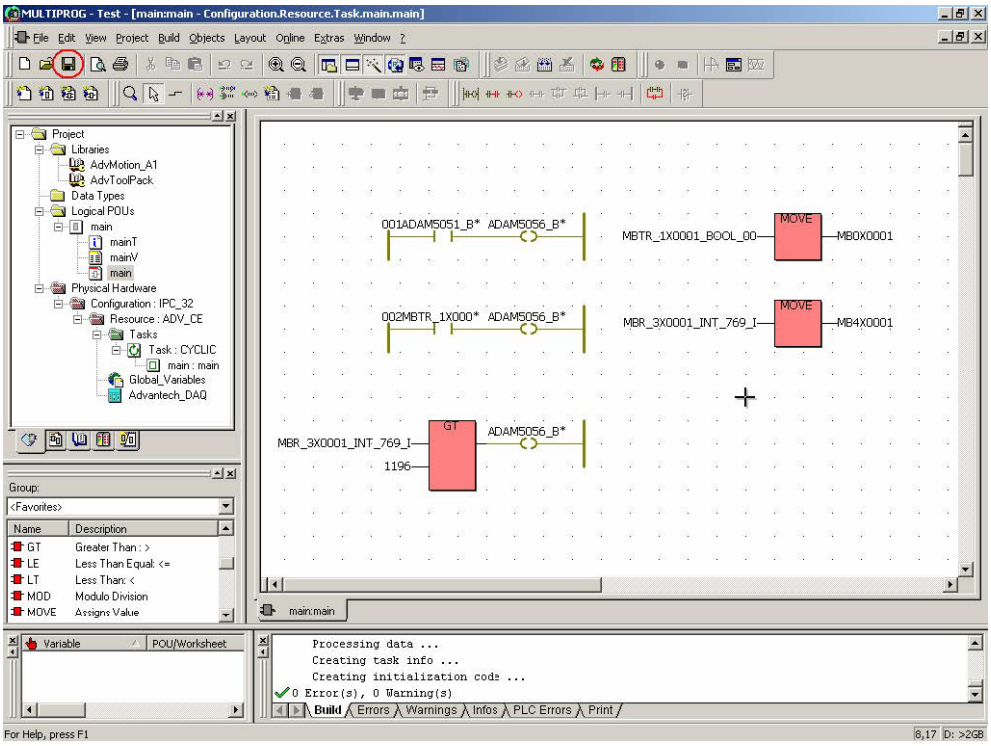
26. Click “Cold” to run the project . Click “Debug on/off” button to see the result.



27. Run Modbus/TCP Client utility Modscan and check the values of I/O address mw3.2 and Modscan I/O address 40002 are the same.



28. Save the project and the test is finished.



Chapter 5

Network Functions

5.1 Web Server Functions

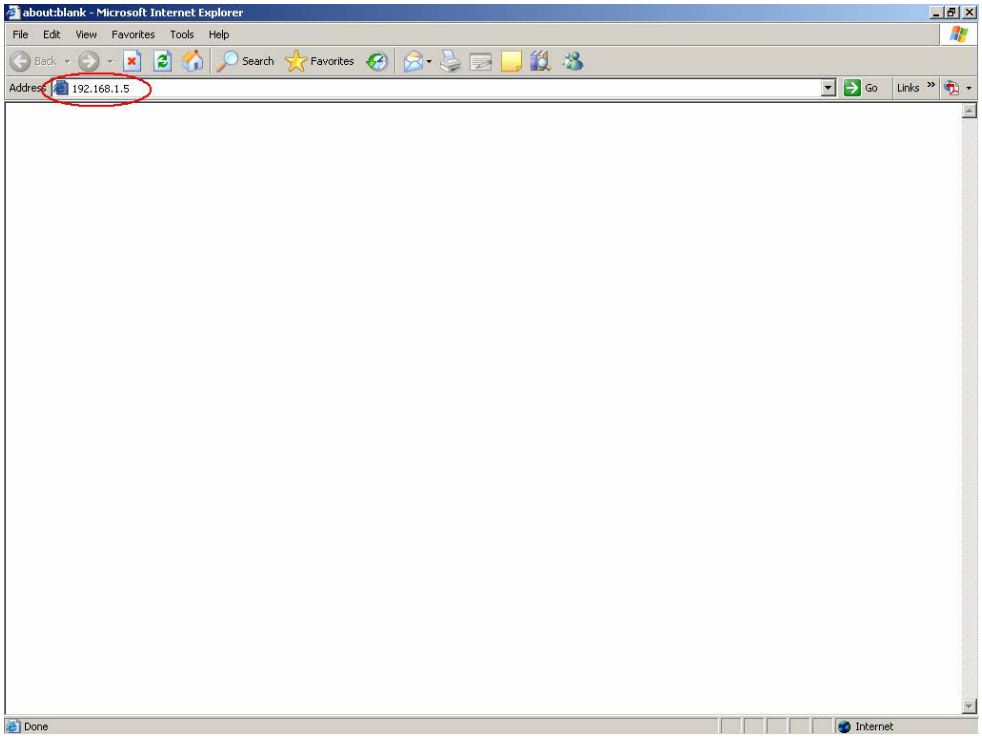
ADAM-5560 Series Controller features built-in web server function of Windows CE 5.0. Before you using the web server function, please do follow the steps in section 7.1.1 to configure the basic settings properly.

For monitoring and controlling the local I/O modules on ADAM-5560 Series Controller, the “Web5550” library, which is based on ISAPI extension, are useful. It has been pre-installed on the WinCE of ADAM-5560 Series Controller.

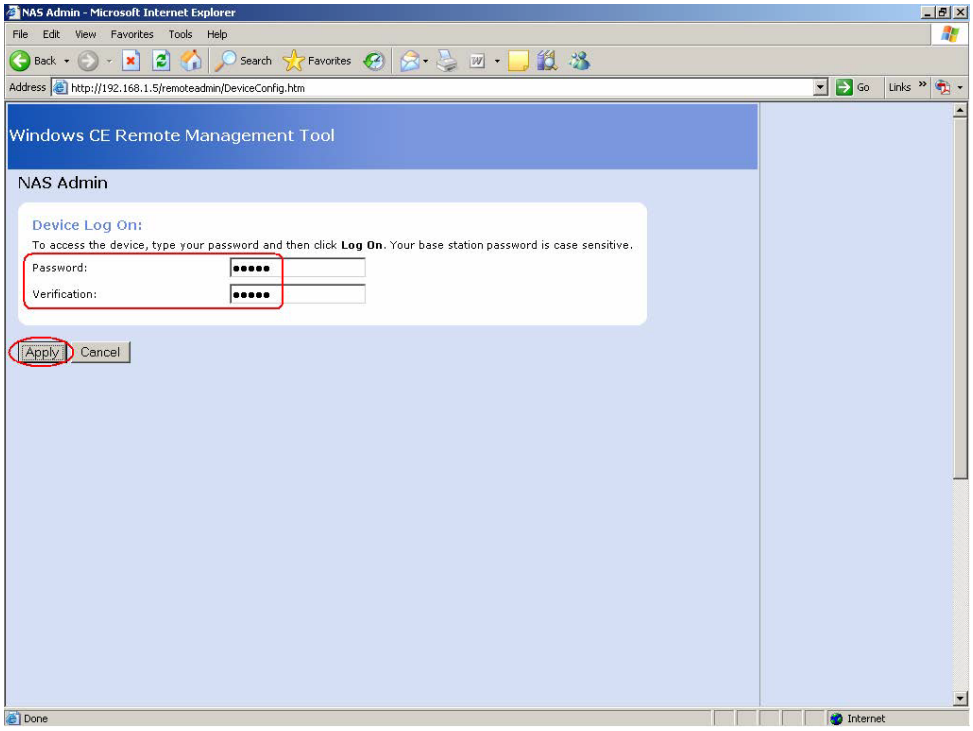
By using the library, the web applications can be developed without coding any program like C or C++. It is possible to develop it as simple webpage design like html. If you would like to make your applications more flexible, JavaScript is a good solution. Please refer to section 7.1.2 for detail technical information.

5.1.1 Configure Web Server

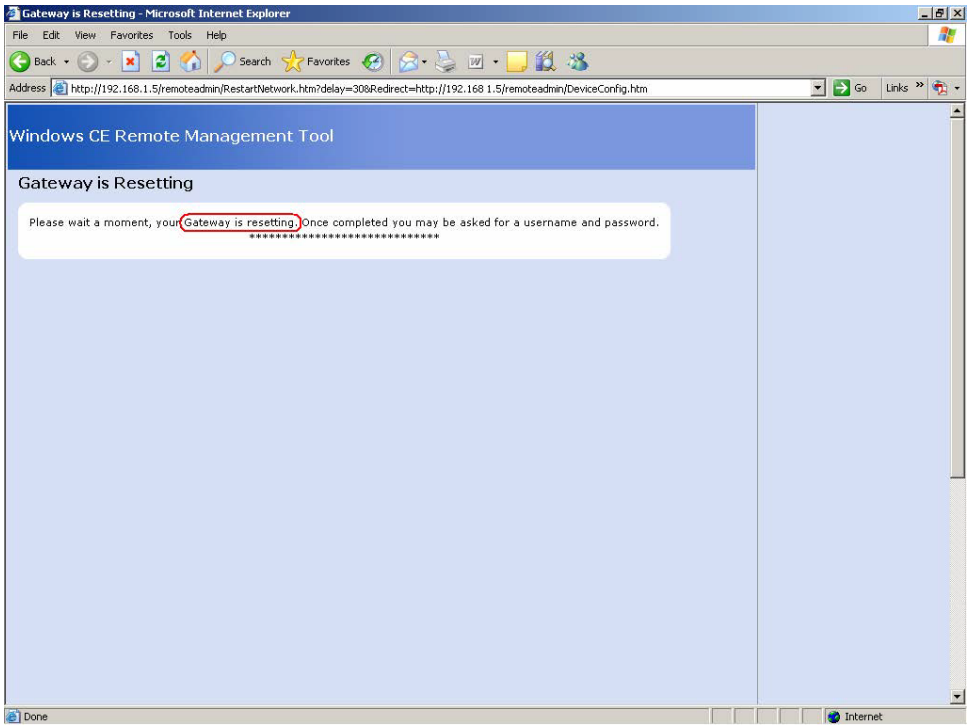
1. Type ADAM-5560 IP Address “http://192.168.1.5” in Internet Explorer.



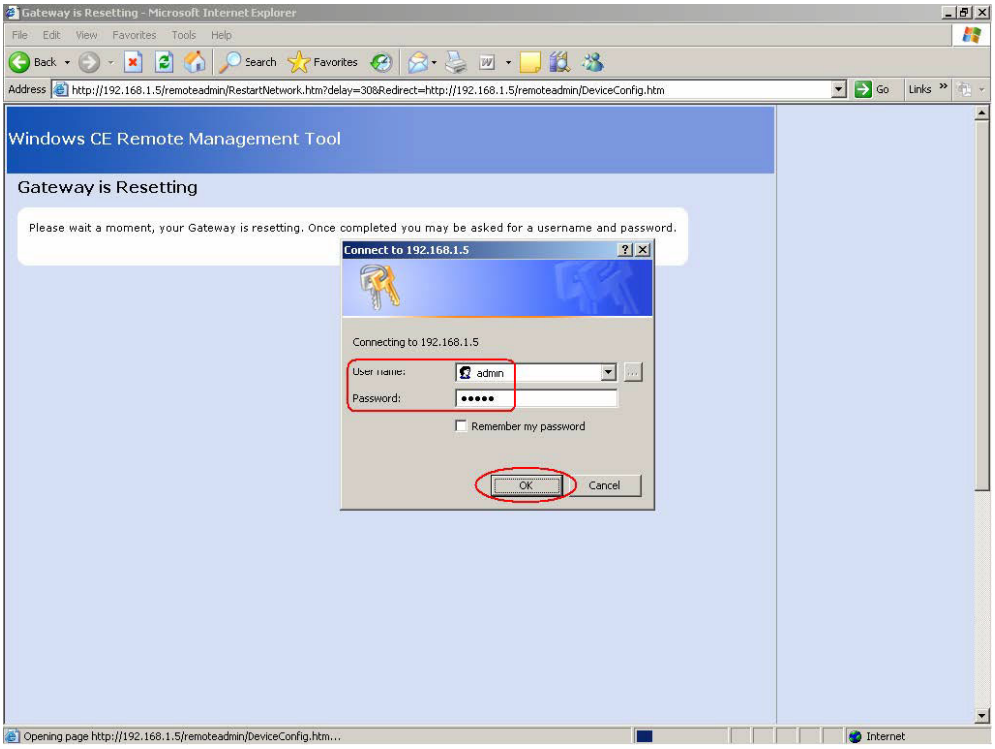
2. The NAS Admin page will be shown. Type in the password, for example, “admin” and then click “Apply”.



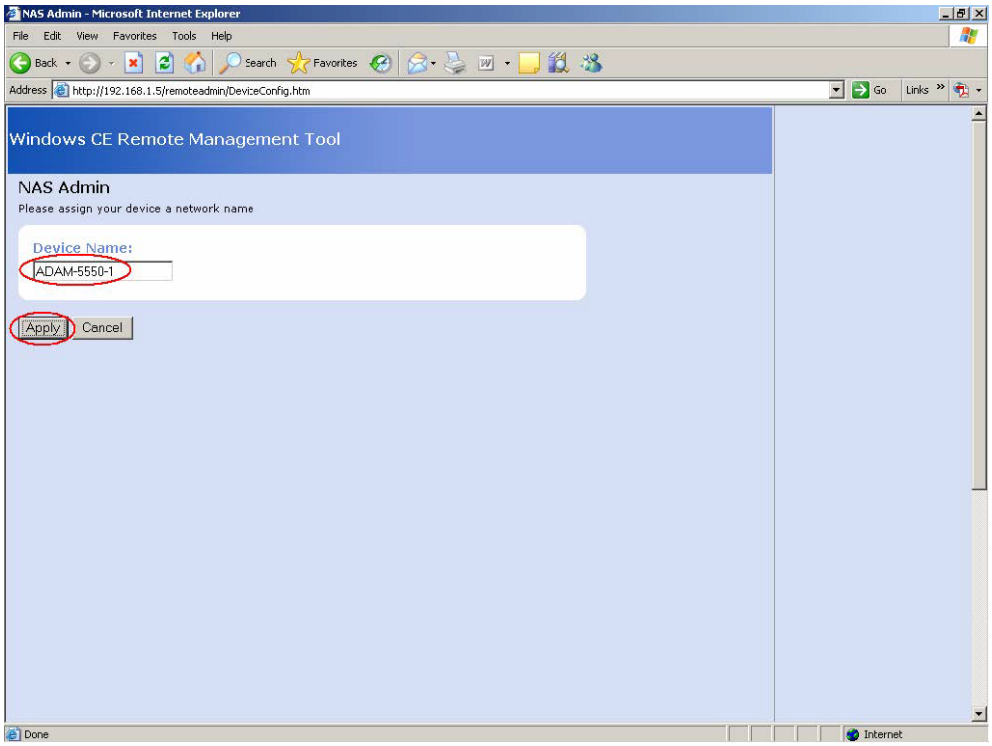
3. Gateway is resetting.



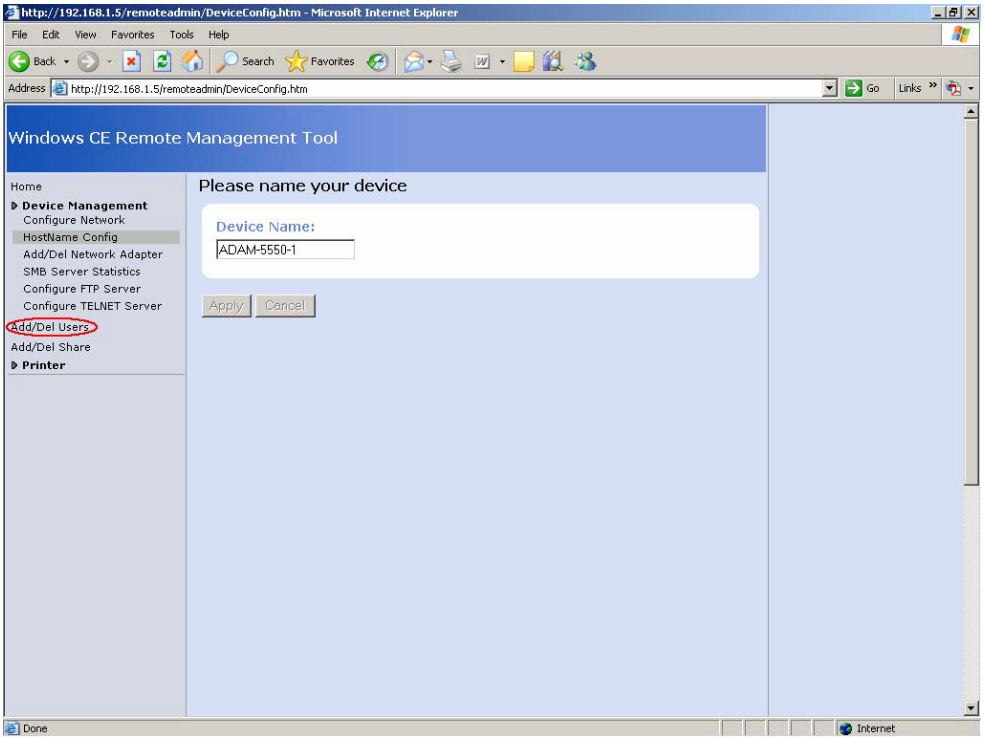
4. Internet Explorer will connect to server automatically and ask to type the user name and password again.



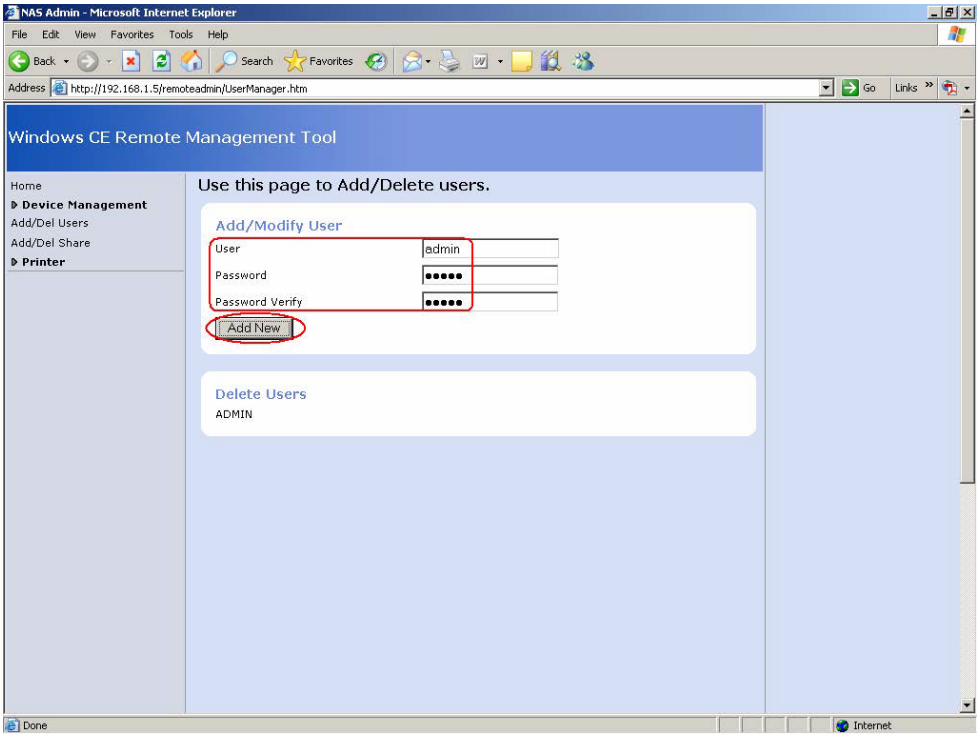
5. Change the Device Name like “ADAM-5510-1” and then click “Apply”.



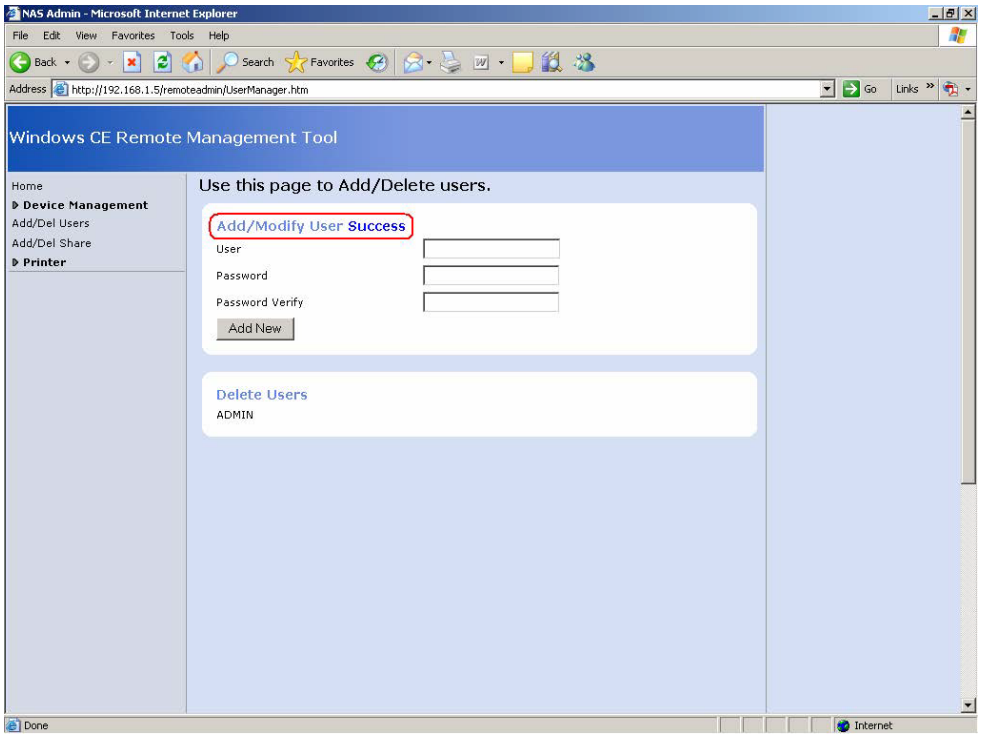
6. Click “Add/Del Users” to change the password of user name “admin”, if necessary.



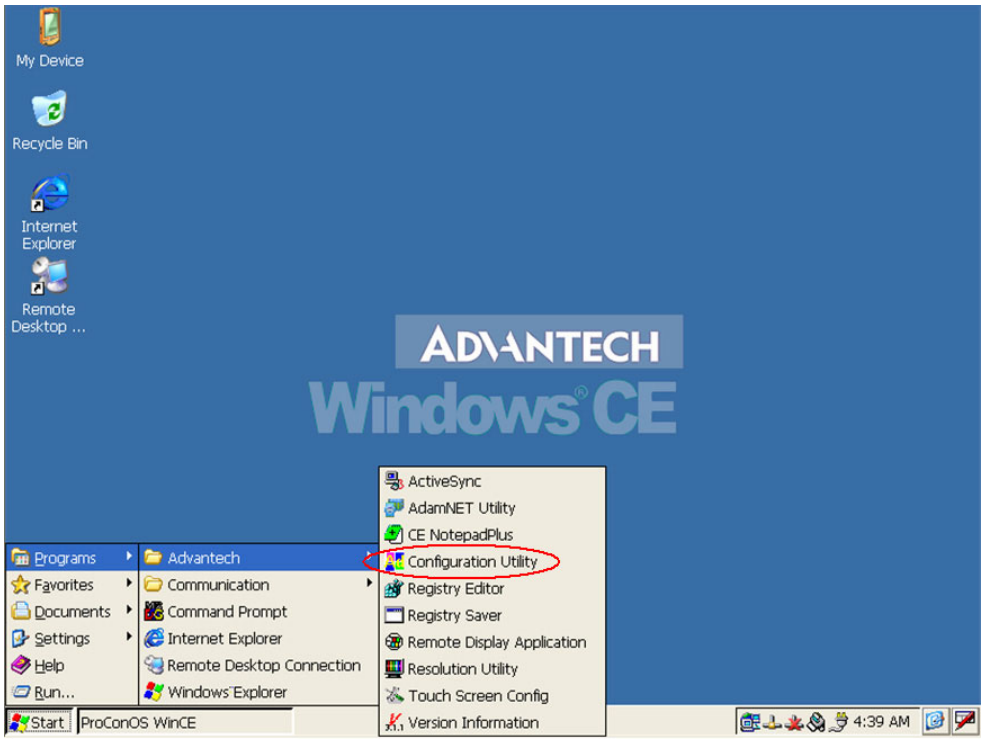
7. Type “admin” in “User” field. In following example, please type “admin” in “Password” field and then click “Apply New”.



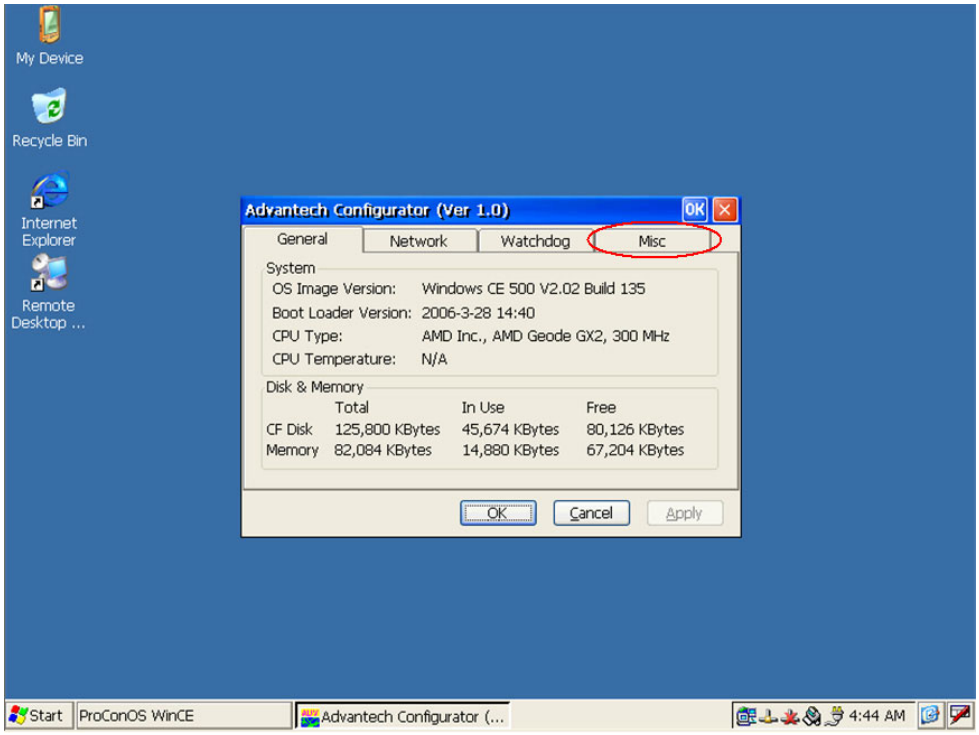
8. The message “Add/Modify User Success” will be shown.



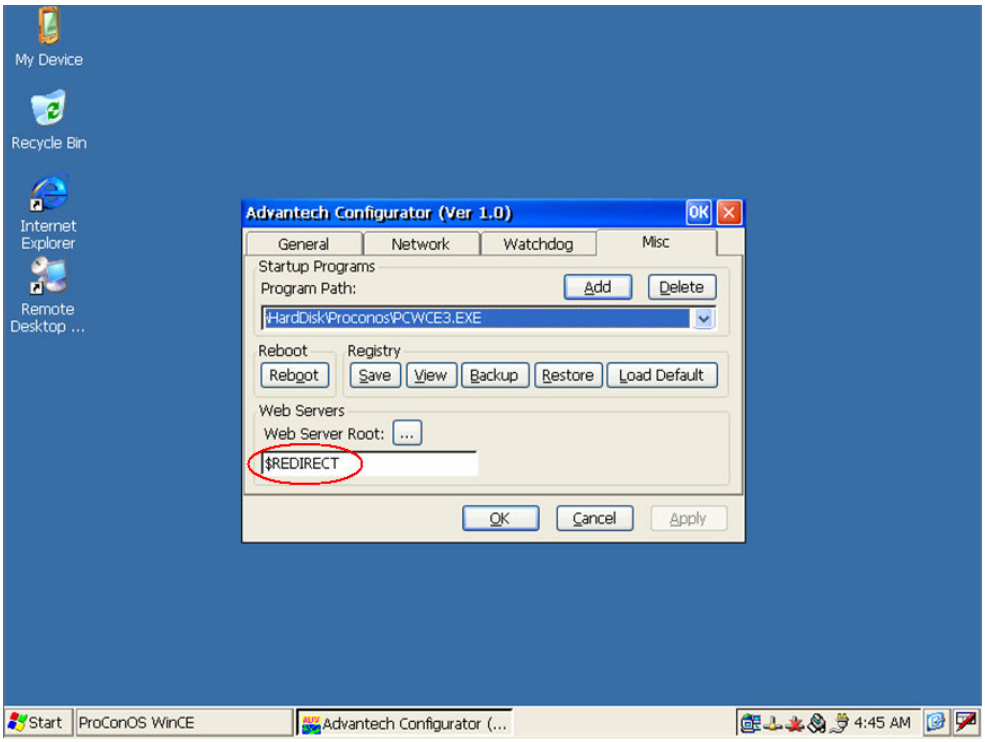
9. Run “Configuration Utility”.



10. Click “Misc” folder.

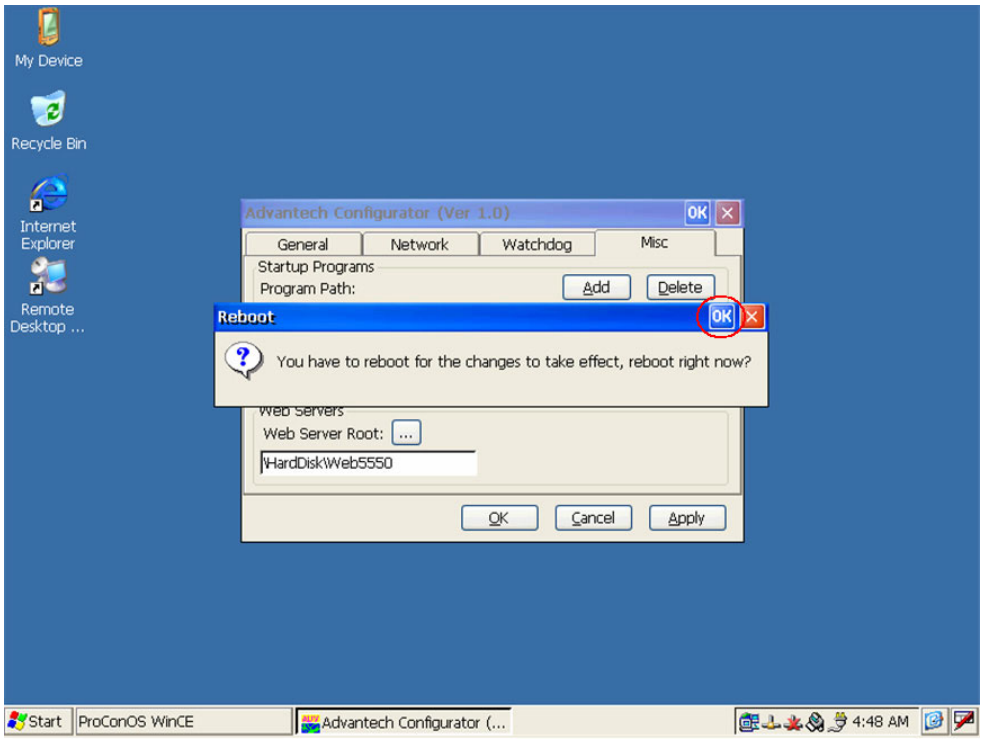


11. Change to “Misc” folder and “Web Server Root” will be modified.



12. User can put the developed web page in the specific folder in ADAM-5560 and link the webpage by change the Web Server Root.

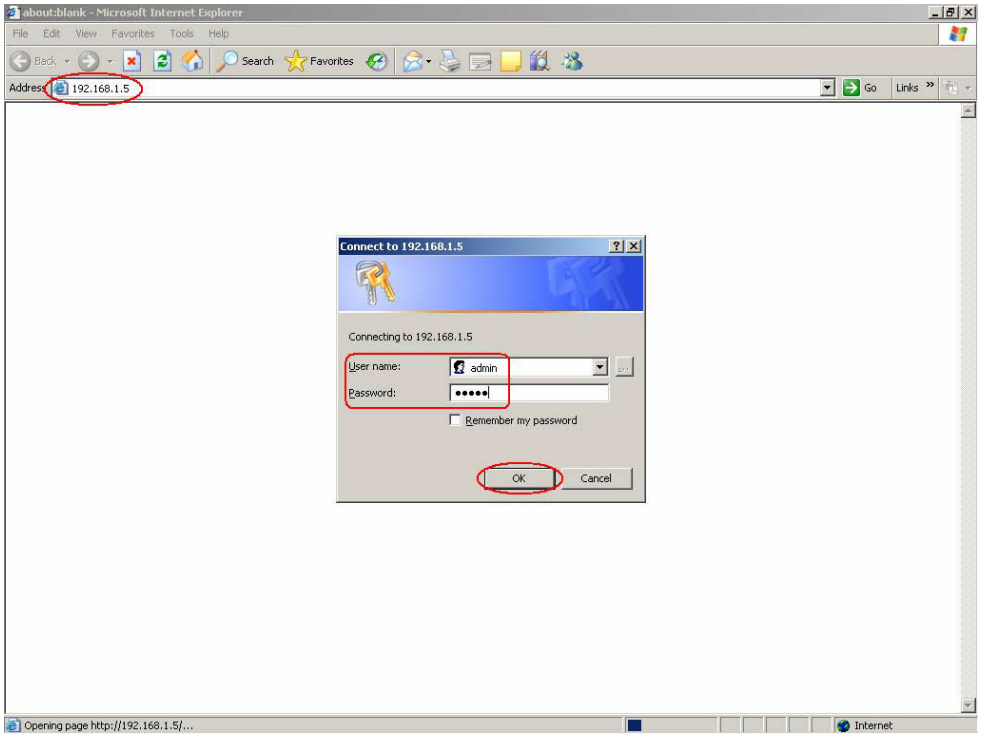
13. Click “OK” to reboot the ADAM-5560.



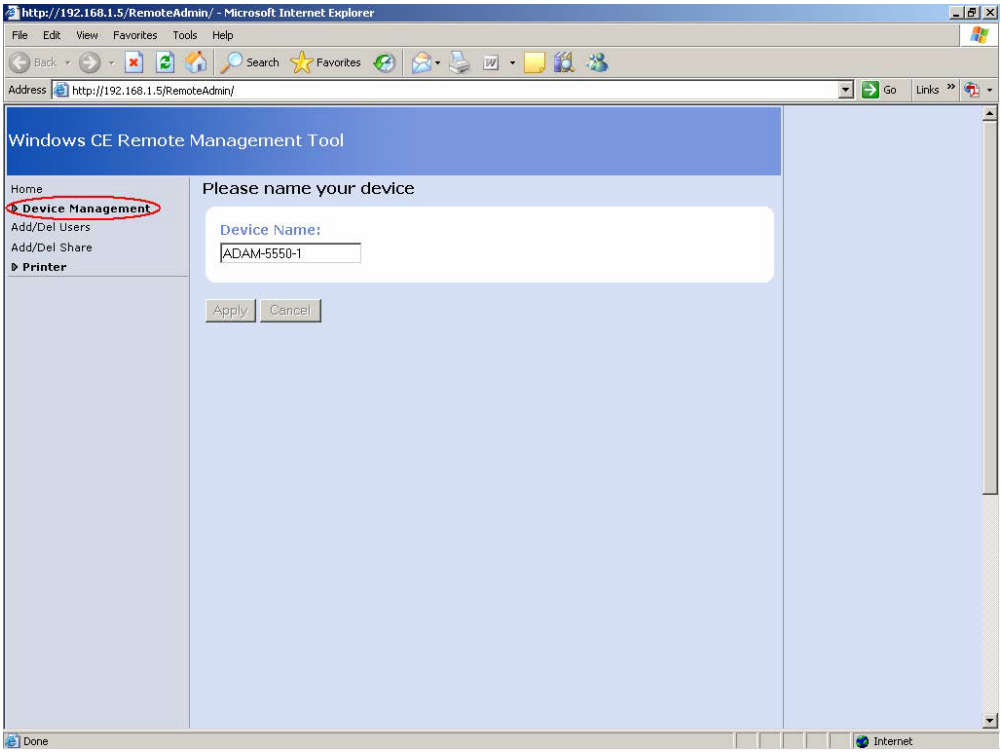
5.2 FTP Server Function

ADAM-5560 Series Controller features built-in FTP Server function of Windows CE 5.0. Before you using the FTP Server function, please do follow the steps as below to configure the basic settings properly. The default setting of FTP Server function in Windows CE 5.0 is disabled. If you enable the FTP Server function and do not configure the settings properly, please be noted that it is possible that malicious user gain completely control of the files on the ADAM-5560 Series Controller.

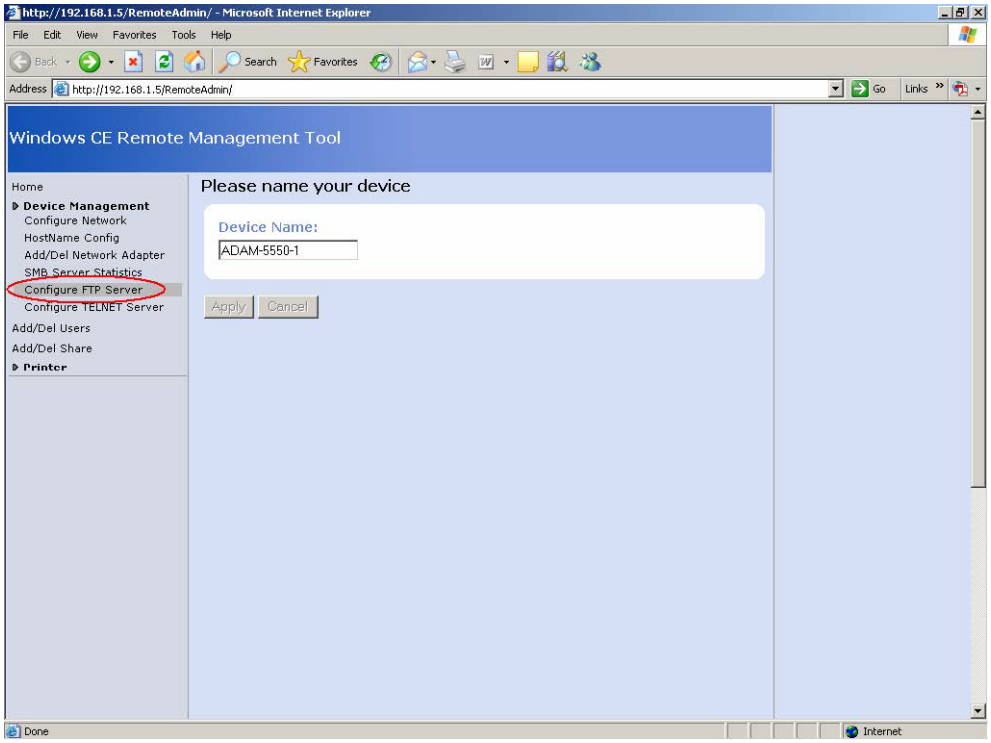
1. Type IP address “http://192.168.1.5”. Enter user name: “admin”, password: “admin” and then click “OK”.



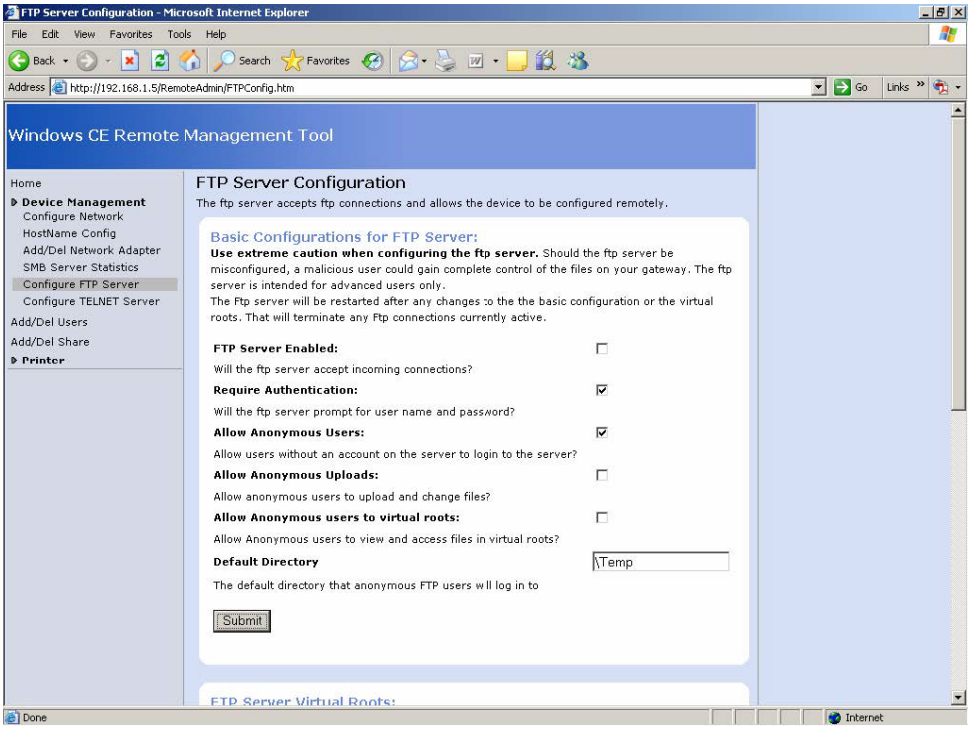
2. Click “Device Management”.



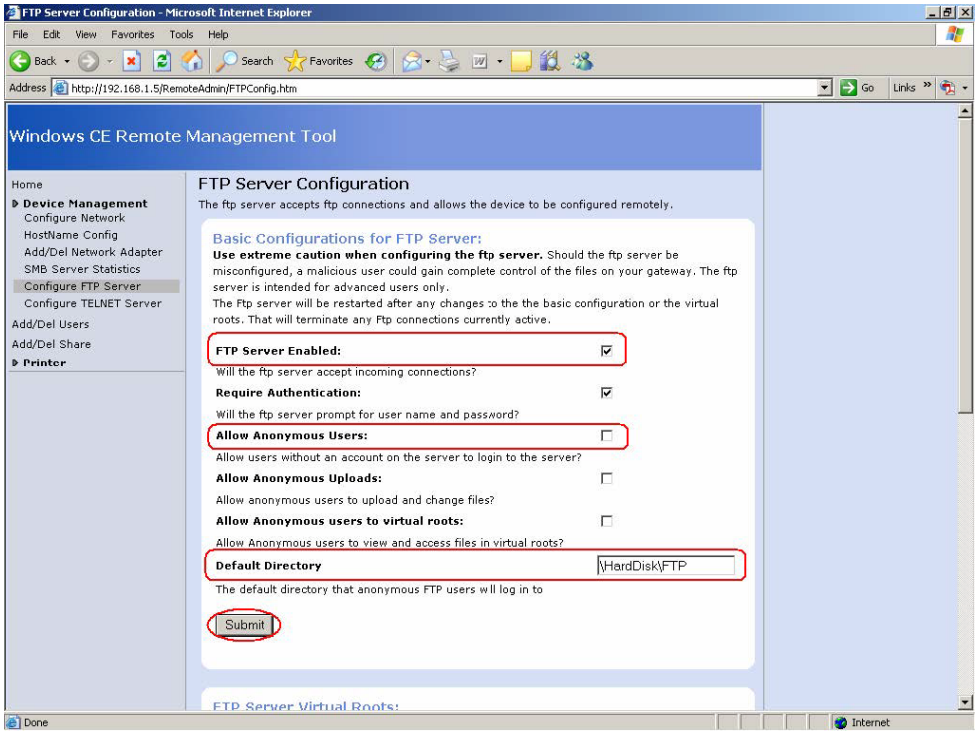
3. Click “Configure FTP Server”.



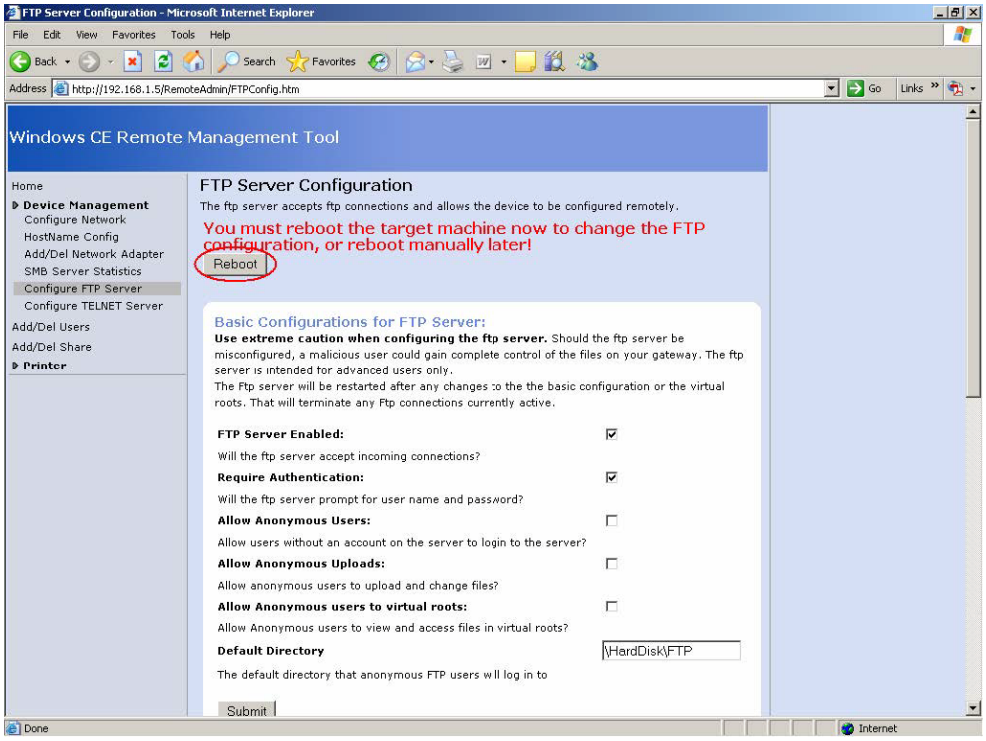
4. Enter the “FTP Server Configuration” page.



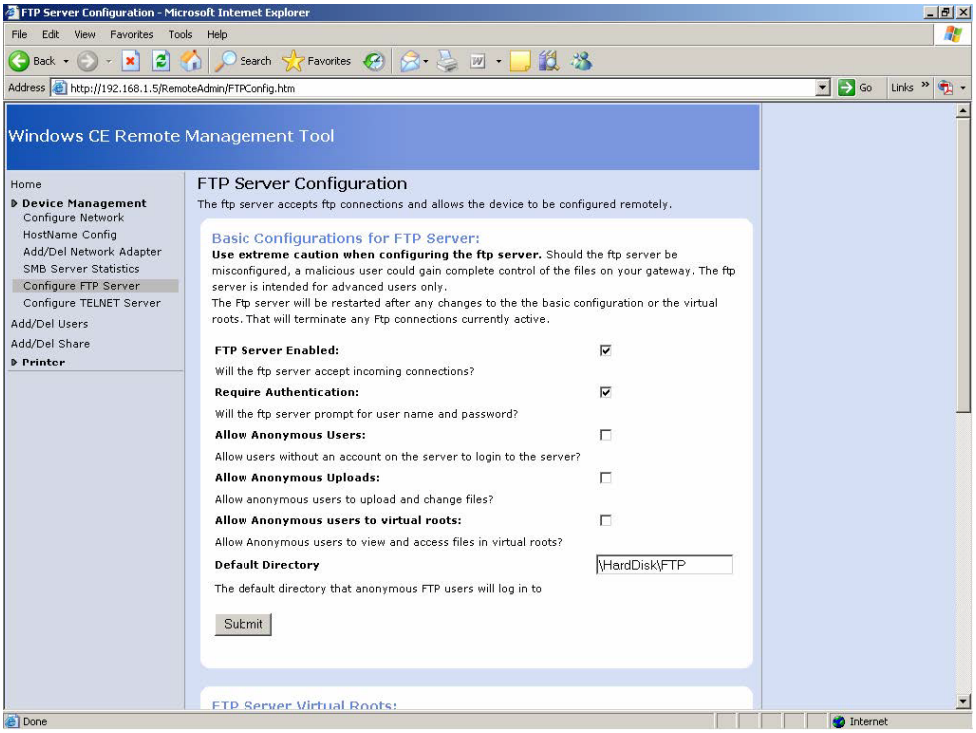
5. Check “FTP Server Enabled”, un-check “Allow Anonymous Users”, change “Default Directory” as “HardDisk\FTP”. Click “Submit” button.



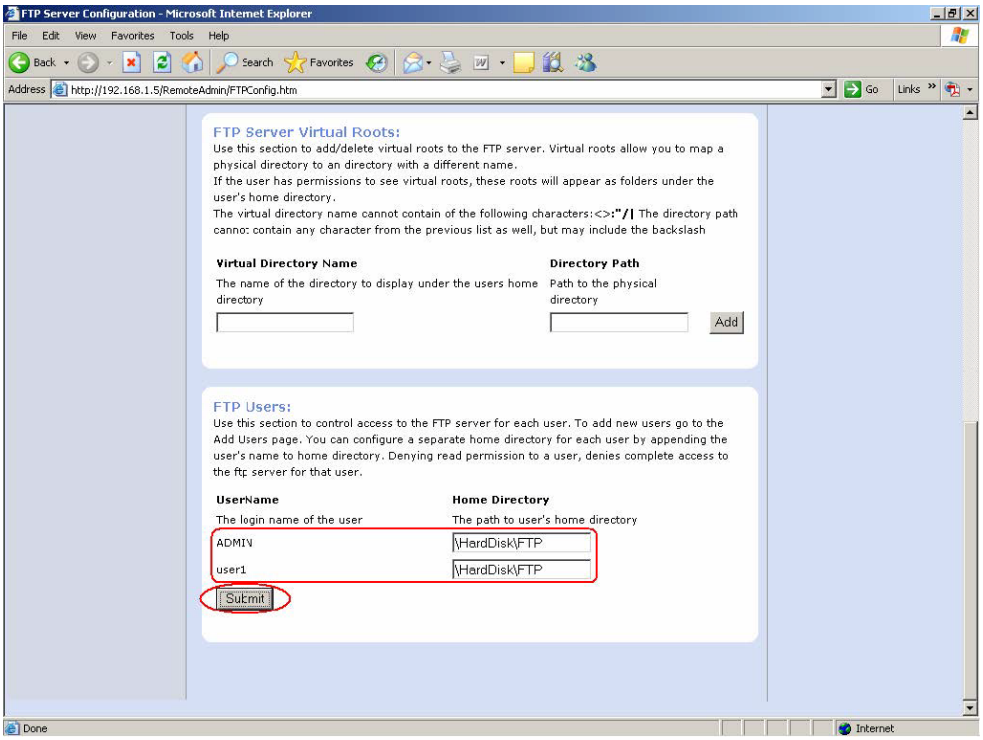
6. Click “Reboot” button.



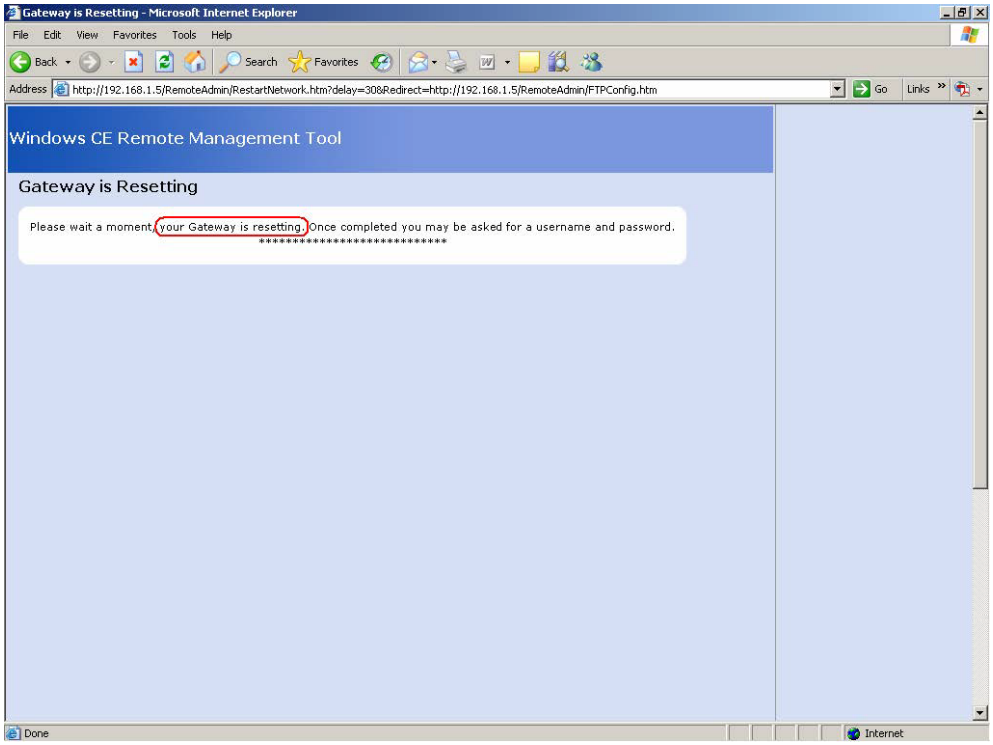
7. After the ADAM-5560 was rebooted, following page will be shown again.



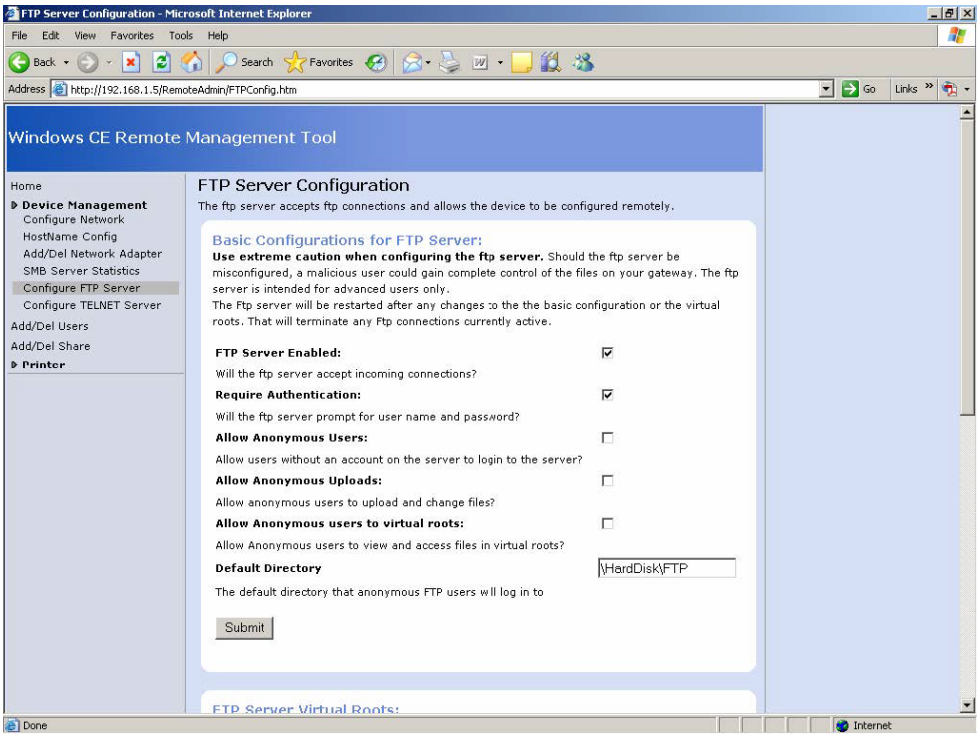
8. Scroll down the page. Check the “Home Directory” for all users and then click “Submit” button.



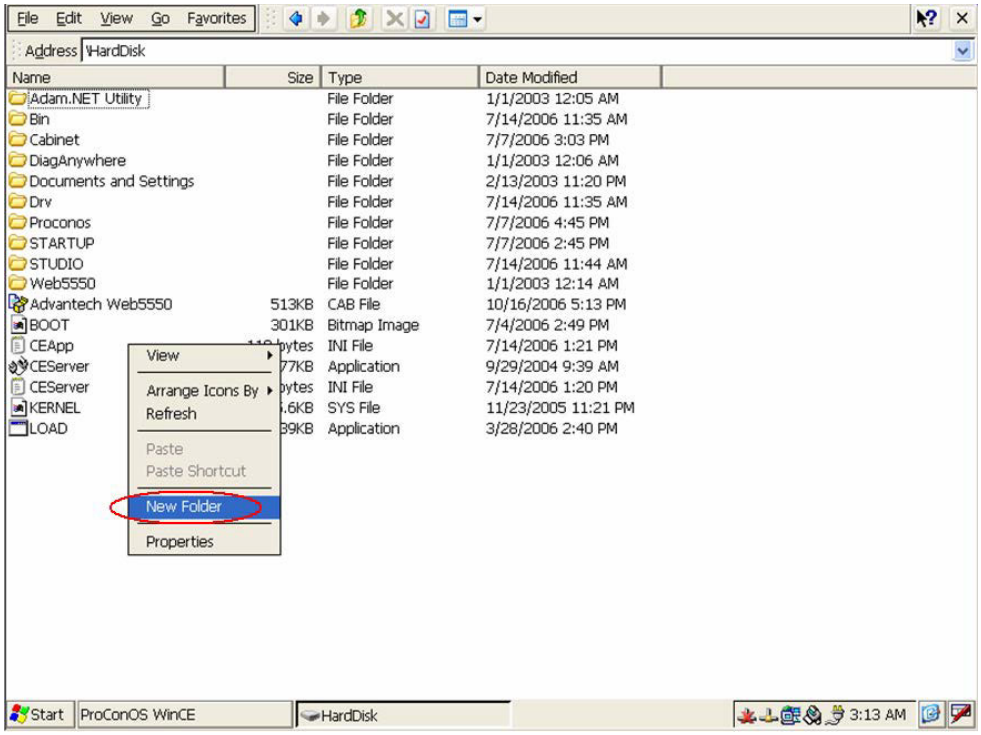
9. Wait for a moment for resetting.



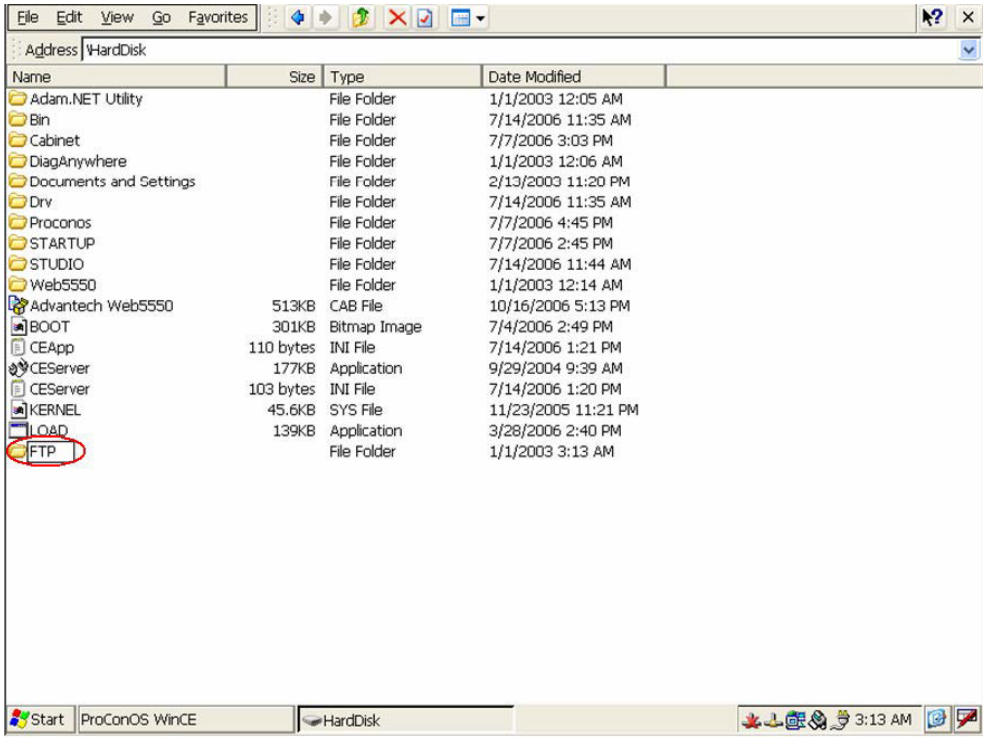
10. After resetting, following page will be shown again. The basic settings for FTP Server have been configured.



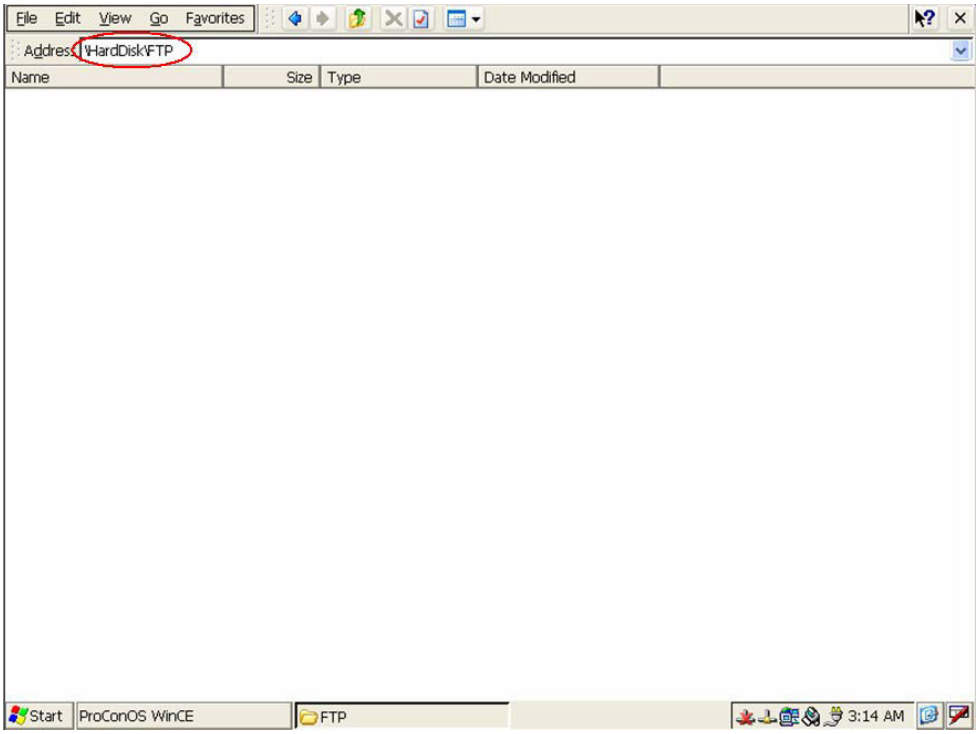
11. Right-click the mouse and then add a new directory “New Folder” under “HardDisk” directory of ADAM-5560 Series Controller.



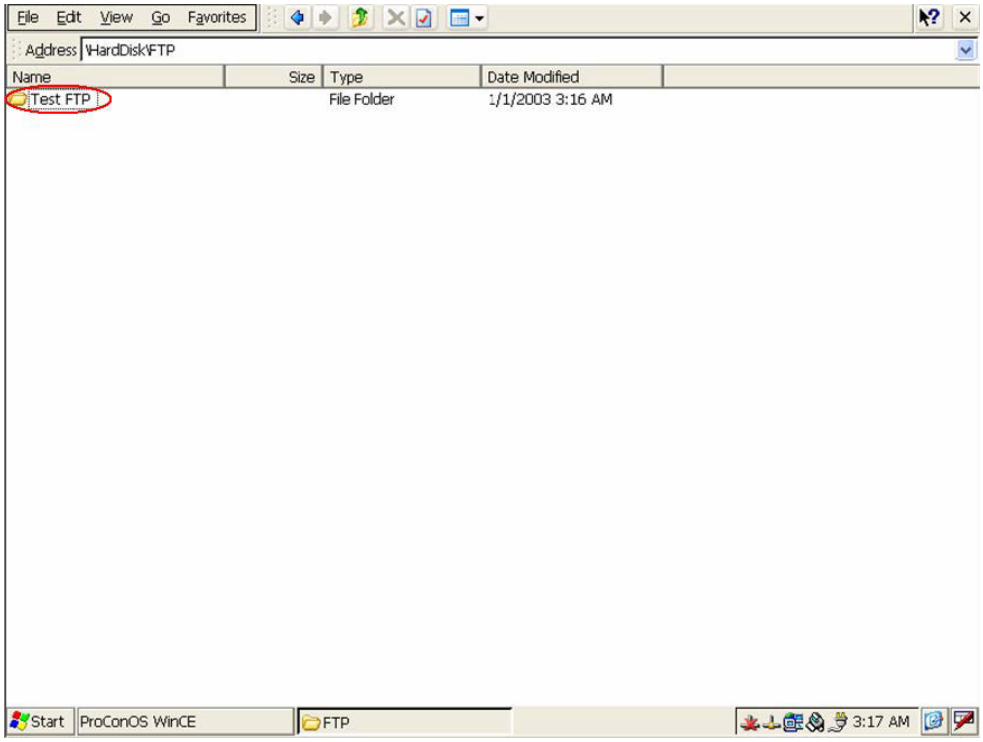
12. Enter the name for the new folder as “FTP”.



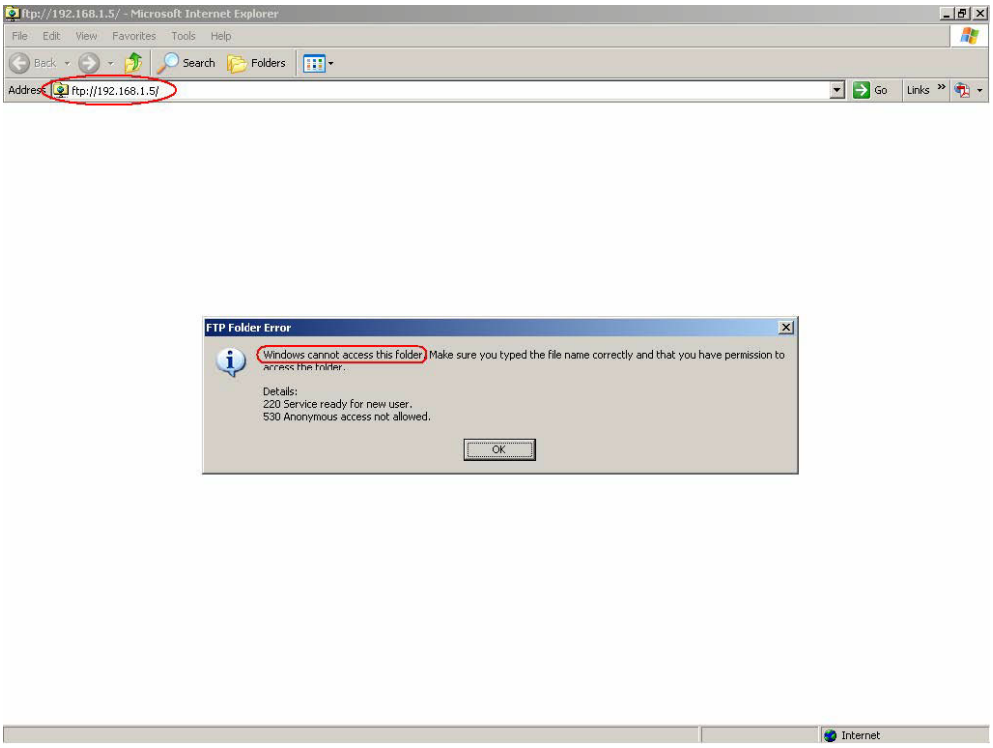
13. Enter “HardDisk\FTP” directory.



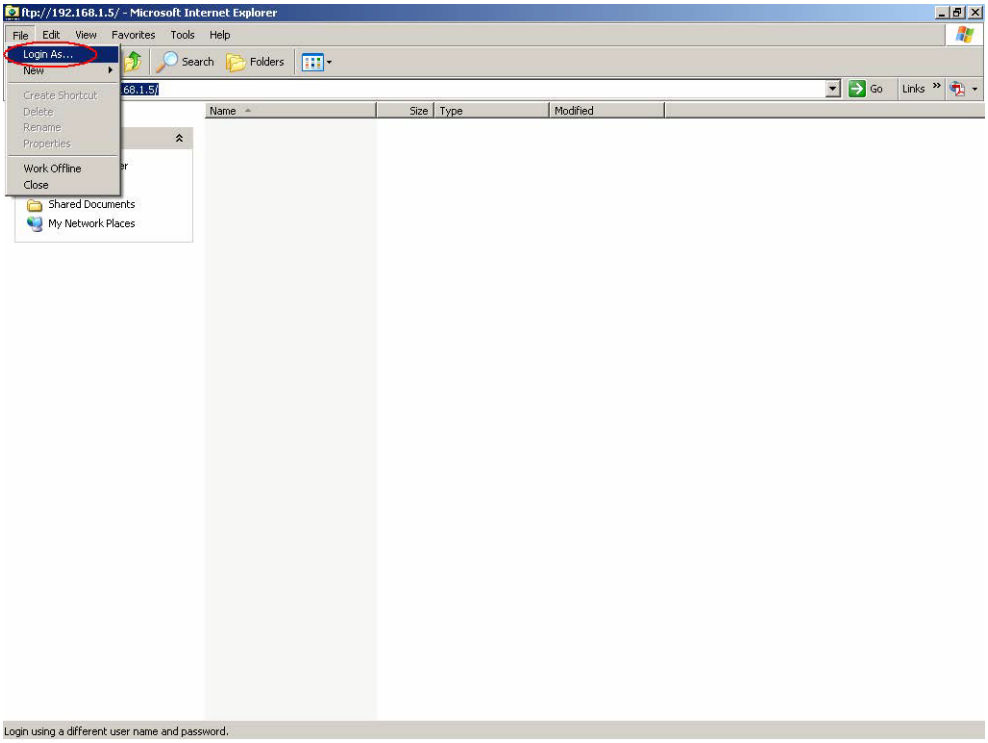
14. Add “Test FTP” directory.



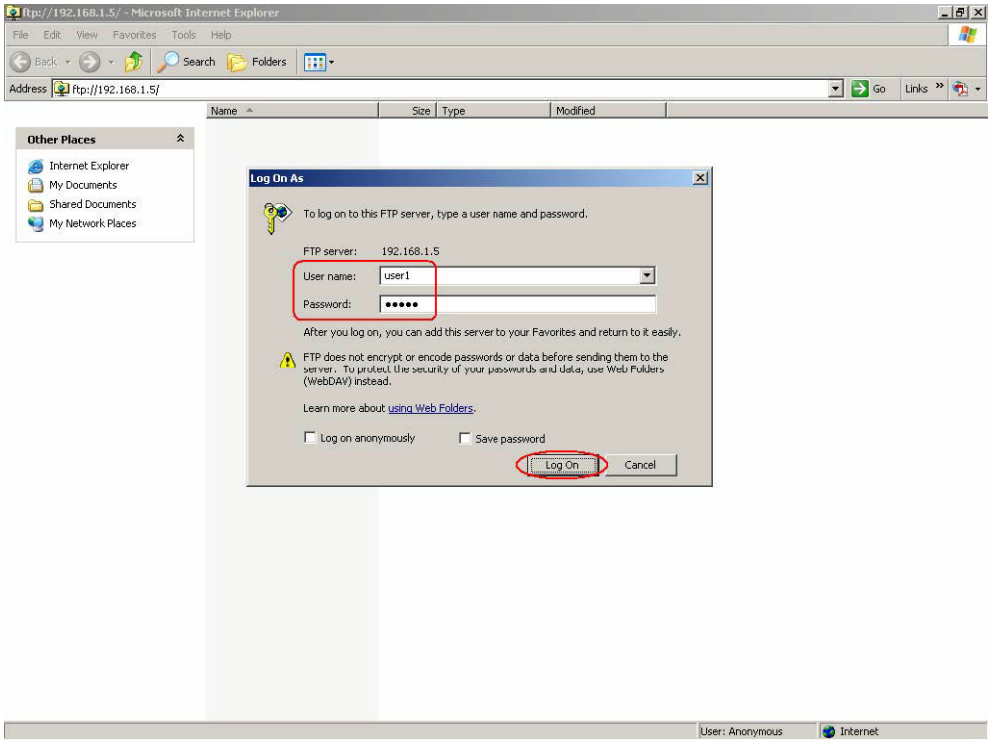
15. Type “ftp://192.168.1.5” to login the FTP Server. You will see the warning message because anonymous login is not allowed now.



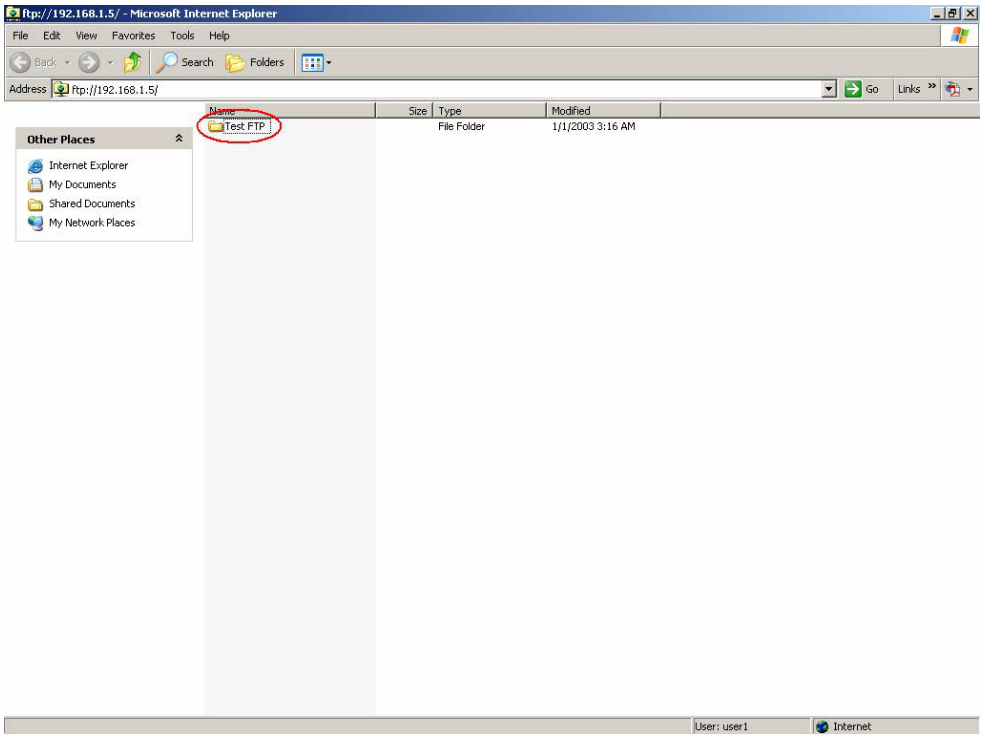
16. Click “Login As” item to enter the user name and password.



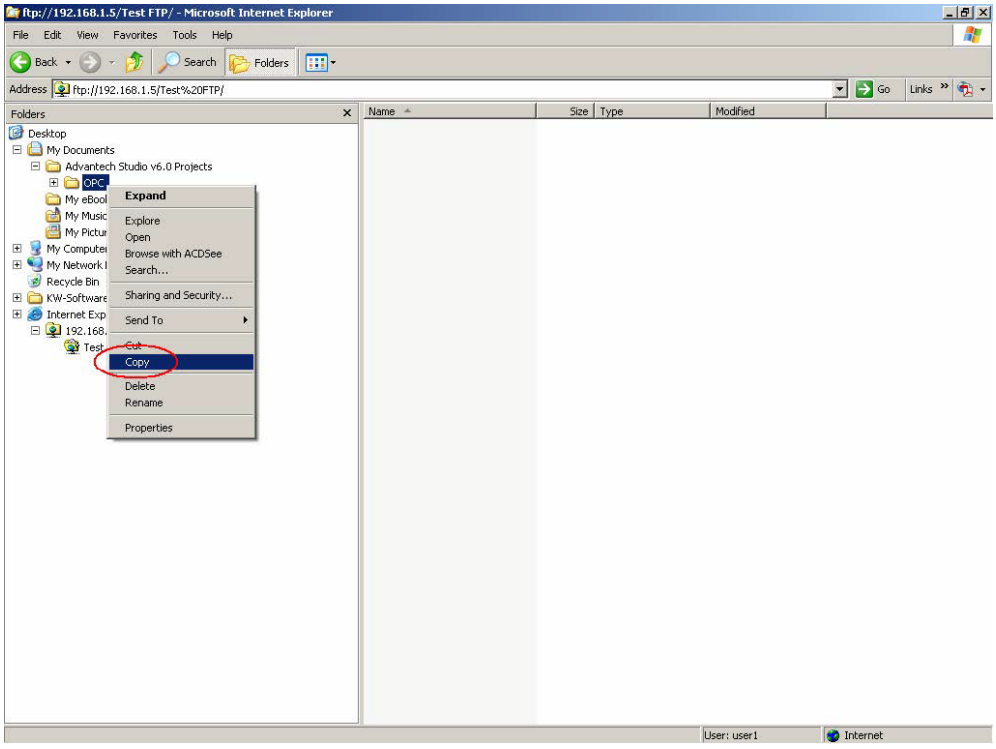
17. Login the FTP Server by username: user1 and password: “user1”.



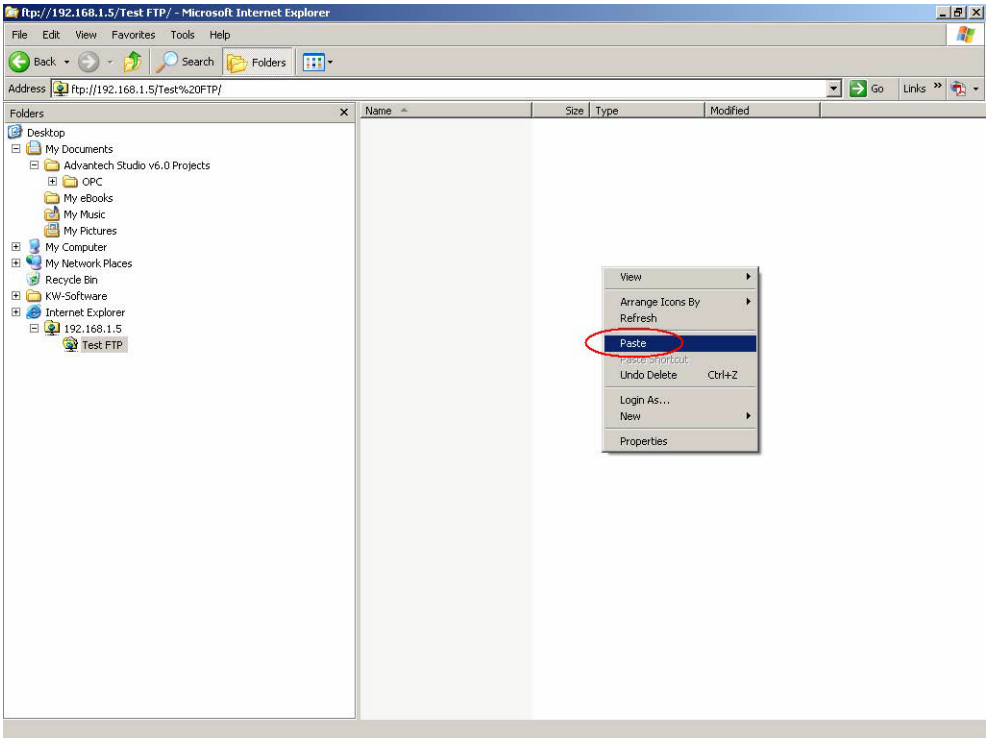
18. The “Test FTP” directory can be accessed now.



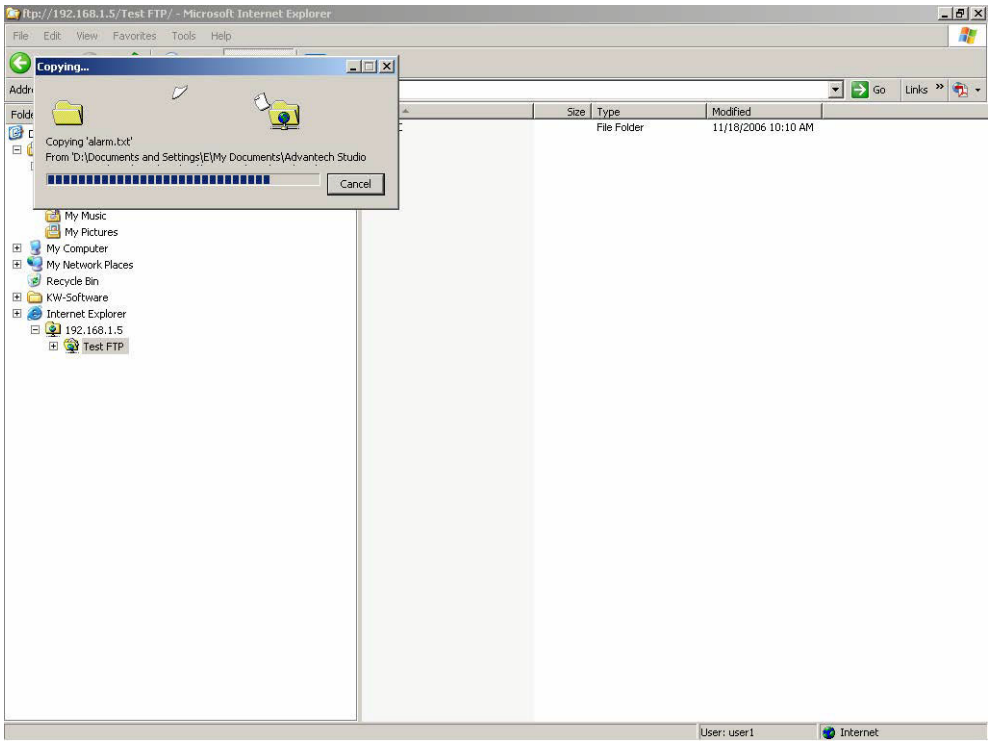
19. Try to upload files onto FTP Server.



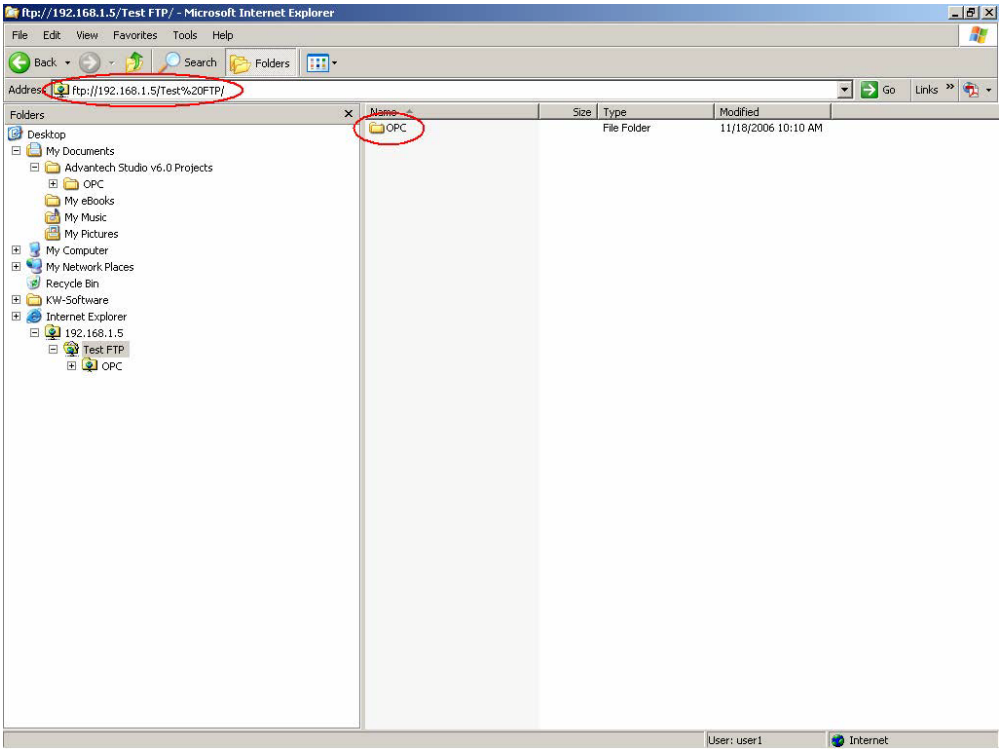
20. Upload the directory of “OPC” onto FTP Server.



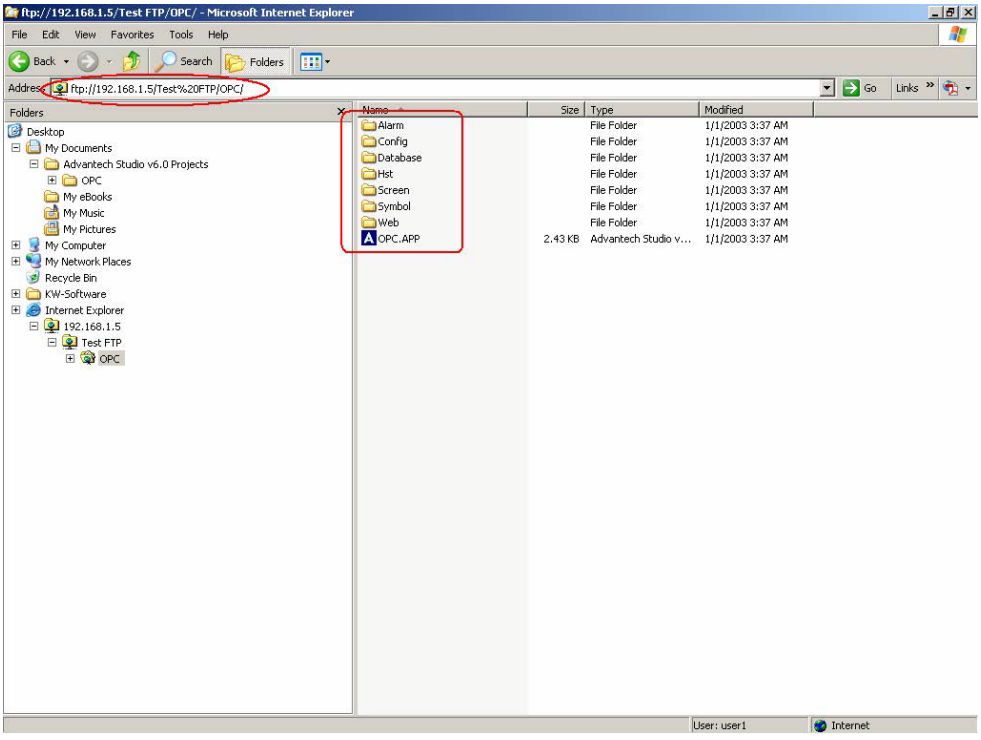
21. Uploading process is proceeding.



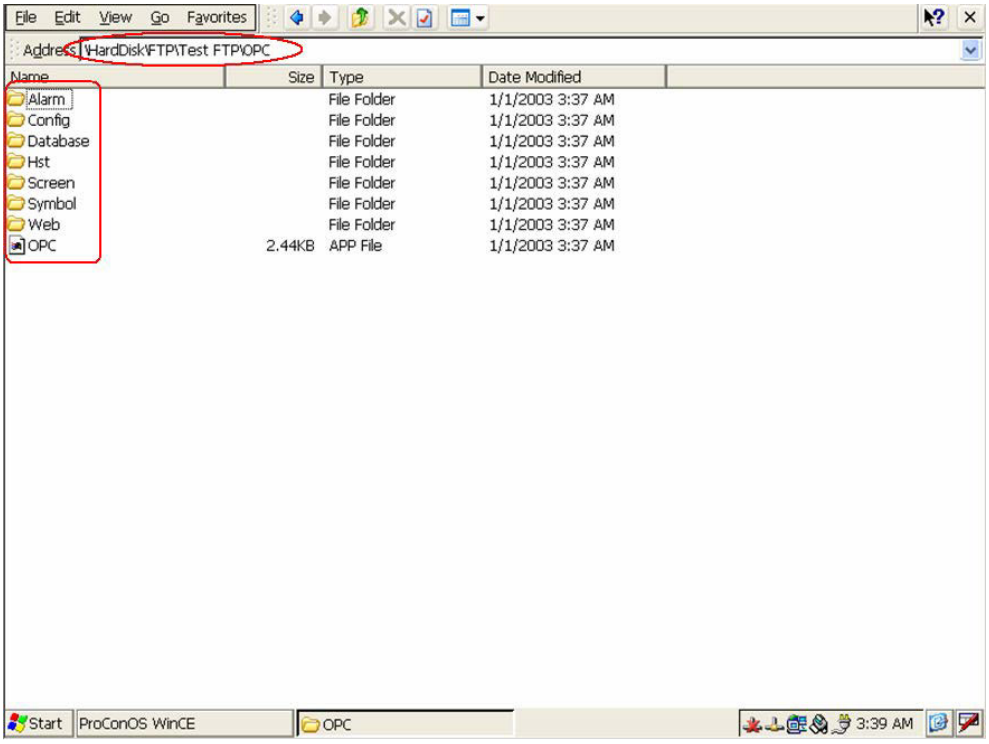
22. The uploaded “OPC” directory will be shown.



23. Check the files under “OPC” directory in FTP client.



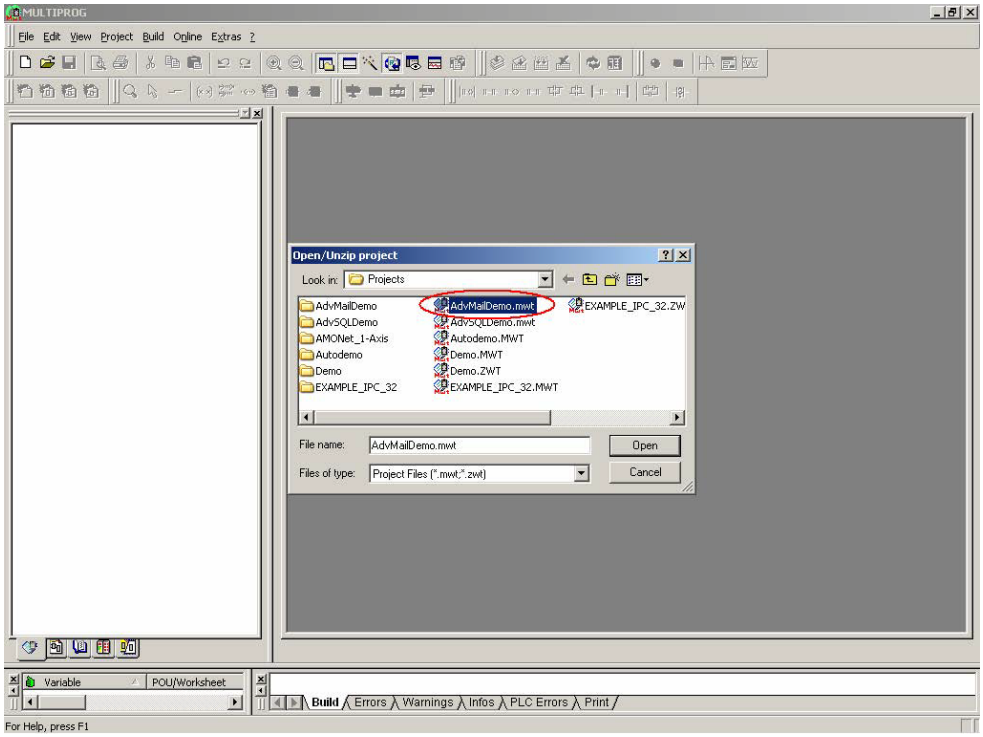
24. Check the files under “OPC” directory on the ADAM-5560.



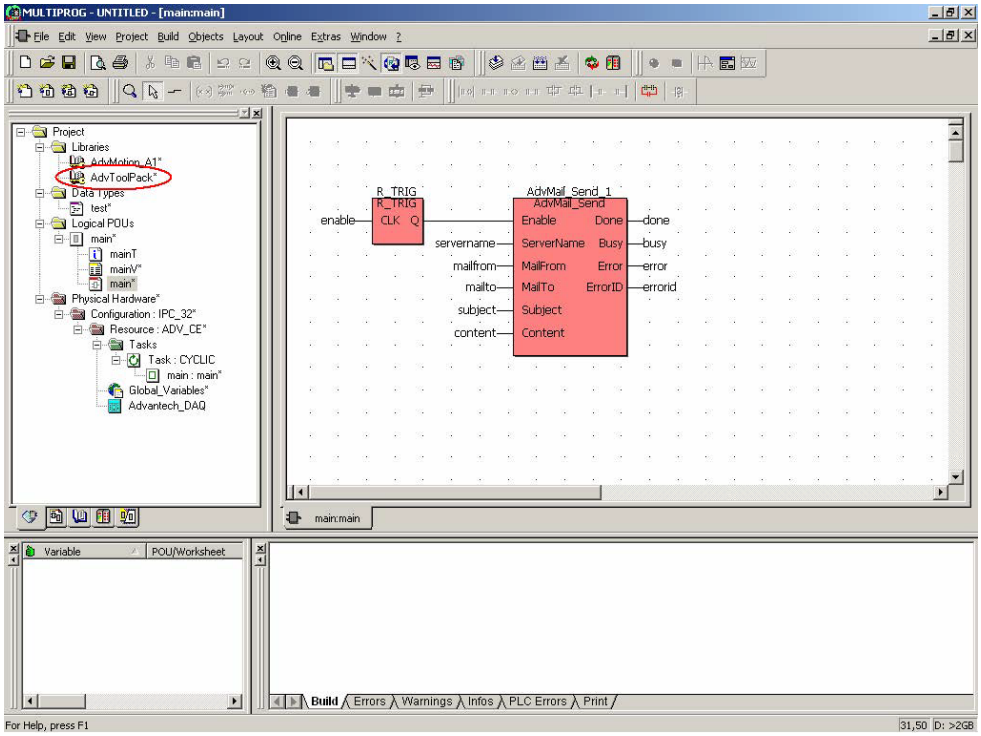
5.3 Email Alarm Function

There is an example for demonstrating how to send an email from ADAM-5560 Series Controller. Please refer to following info.

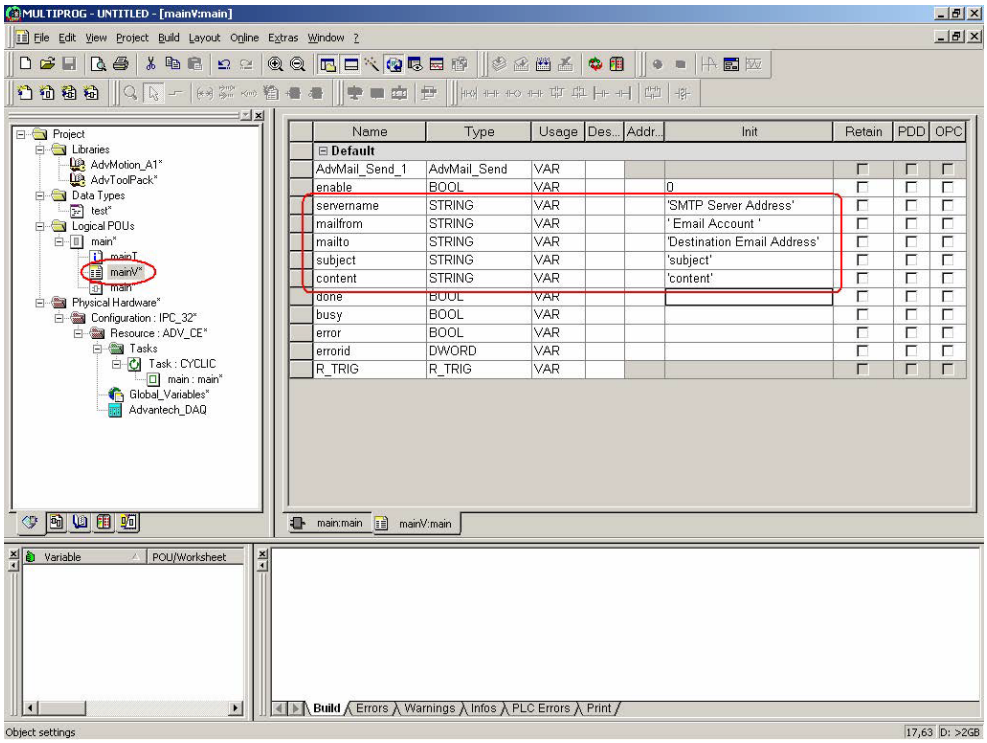
1. Open “AdvMailDemo.mwt”.



2. The function block is included by “AdvToolPack” library. Double-click “main” to see the function block.



3. Type the correct settings in the “Init” fields as below and try to run this example directly.

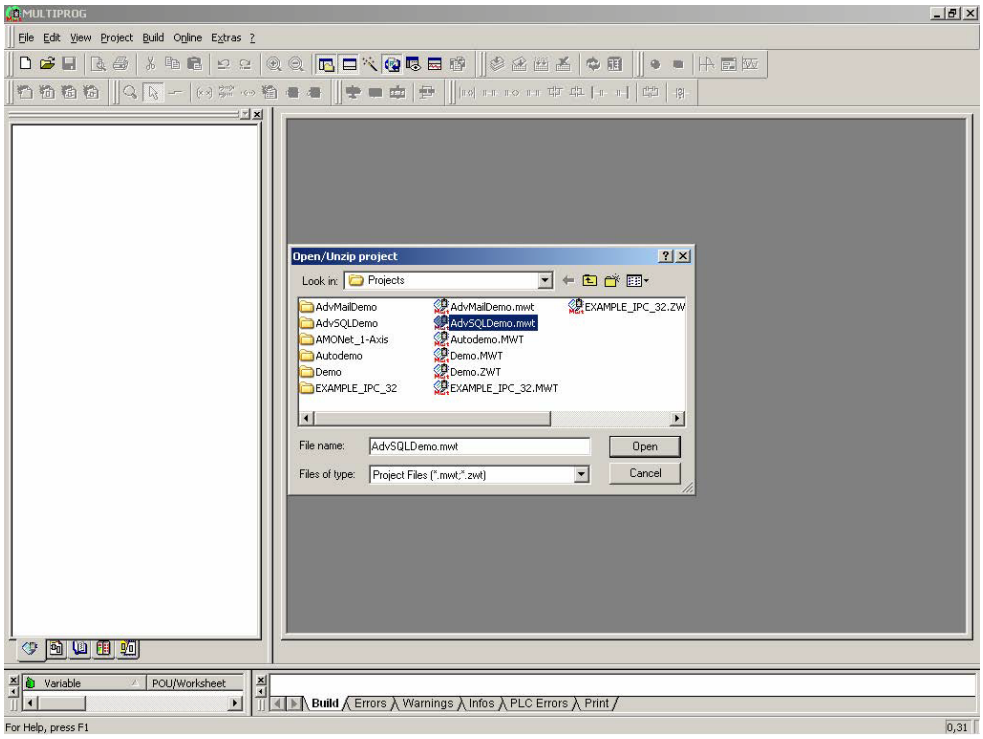


Note! *The sending email function is only supported by mail server via intranet within enterprise network. The free mail box cannot support the sending email function.*

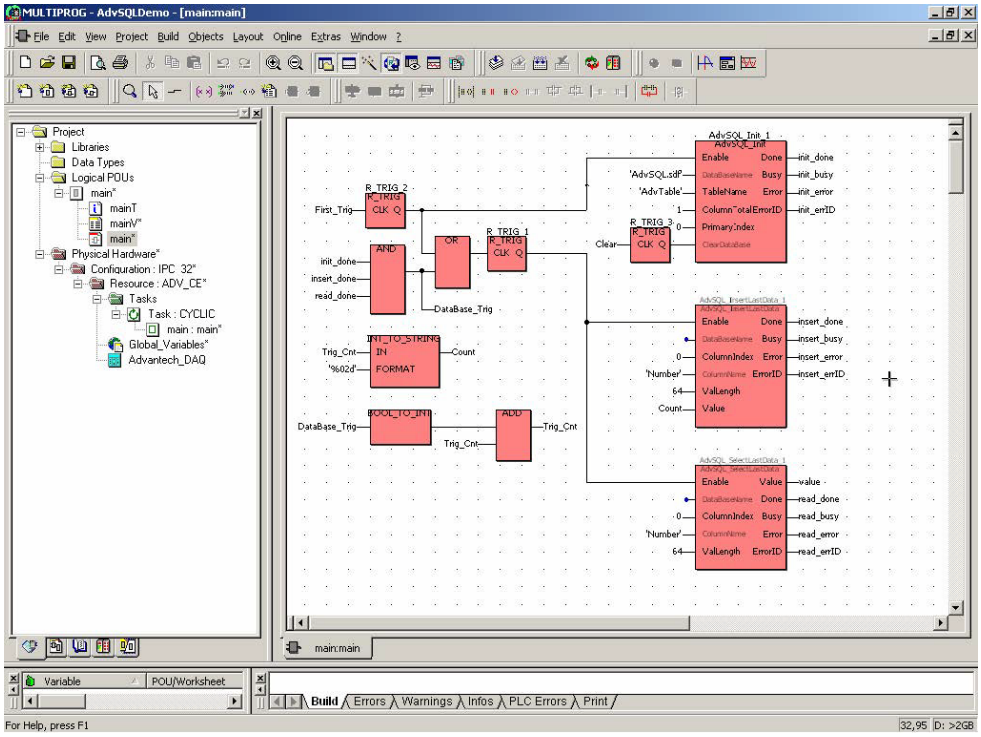
5.4 SQL Server Function

There is an example for demonstrating how to use the built-in SQL Server function on ADAM-5560 Series Controller. Please refer to following info.

1. Open “AdvSQLDemo.mwt”.

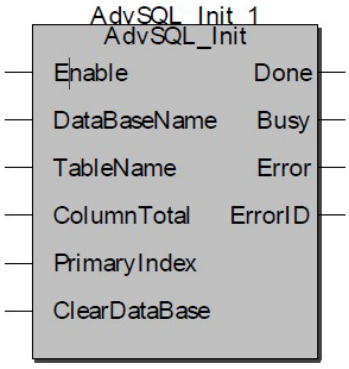


2. Type to run this example directly.



SQL Function Block Reference:

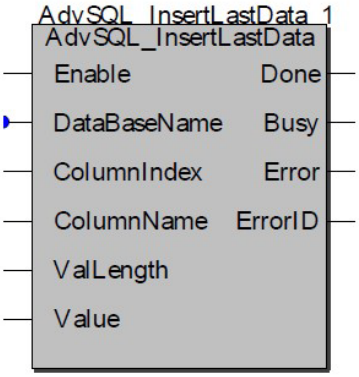
AdvSQL_Init



Function: Initialize SQL mobile database.

1. Enable: (BOOL), Enable AdvSQL function blocks.
2. DataBaseName: (STRING), SQL mobile database name.
3. TableName: (STRING), SQL mobile database table name.
4. ColumnTotal: (INT), Total number of fields in SQL mobile database. Maximum number is 10.
5. PrimaryIndex: (INT) KEY Index of SQL mobile database.
6. ClearDataBase: (BOOL), Clear SQL mobile database.

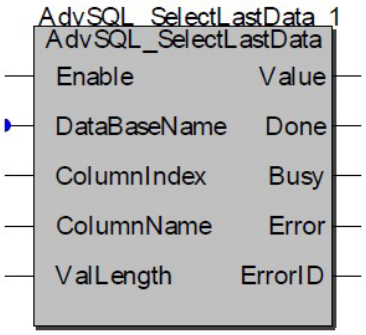
AdvSQL_InsertLastData



Function: Append one record to SQL mobile database.

1. Enable: (BOOL), Enable AdvSQL function blocks.
2. DataBaseName: (STRING), SQL mobile database name. Rreserved for handling more than one SQL mobile database in the future.
3. ColumnIndex: (INT), The column index in SQL mobile database.
4. ColumnName: (STRING), Name of SQL mobile database.
5. ValLength: (INT), Maximum length of data field.
6. Value:(STRING), Content of data field.

AdvSQL_SelectLastData



Function: Read the last record from SQL mobile database.

1. Enable: (BOOL), Enable AdvSQL function blocks.
2. DataBaseName: (STRING), SQL mobile database name. Rreserved for handling more than one SQL mobile database in the future.
3. ColumnIndex: (INT), The column index in SQL mobile database.
4. ColumnName: (STRING), Name of SQL mobile database.
5. ValLength: (INT), Maximum length of data field.
6. Value:(STRING), Content of data field.

Chapter 6

Miscellaneous Functions

6.1 Advantech Utilities

There are four Advantech utilities which are pre-installed on ADAM-5560 Series Controller. The major functions are as below.

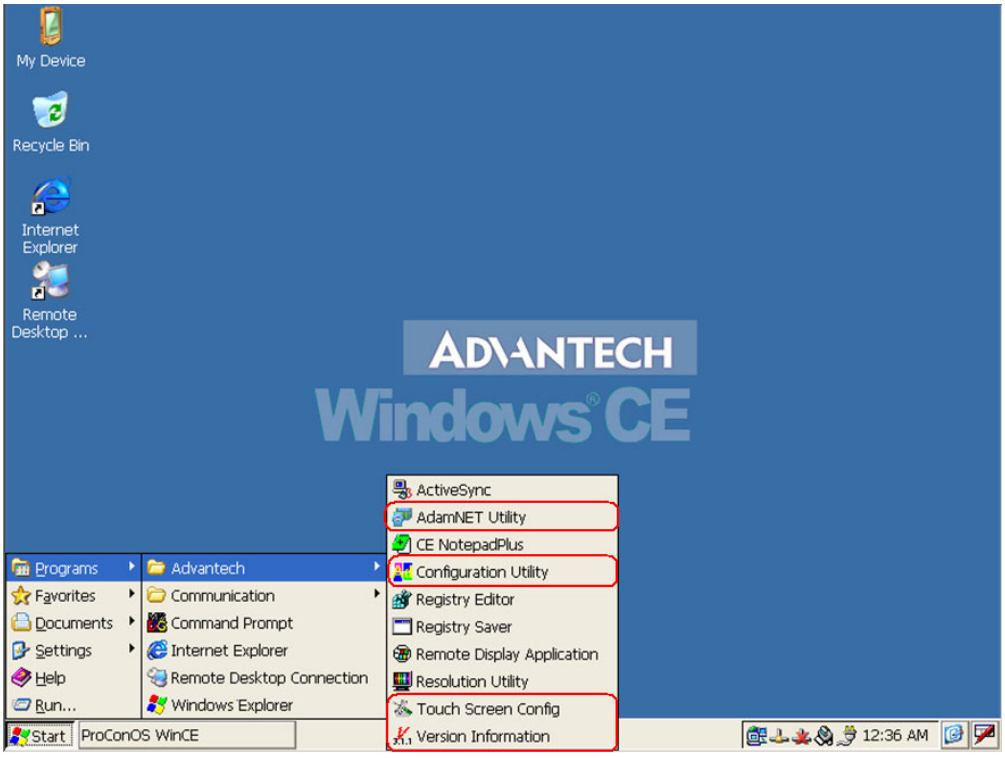
Adam.NET Utility: CE version of ADAM Utility for configuring ADAM-5560 Series Local ADAM-5560 I/O Modules, ADAM-4000 Remote I/O Modules, ADAM-6000 and ADAM-5560/TCP Ethernet I/O Modules. Most of the functions are mentioned in Chapter 3 and Chapter 5.

Configuration Utility: Configure Auto-startup Programs, Web Server Root Directory and Watchdog Timer, etc. Chapter 4 has mentioned how to configure Auto-startup Programs.

Touchscreen Configure Utility: Configure the pre-installed touch screen driver. Please refer to section 7.3.

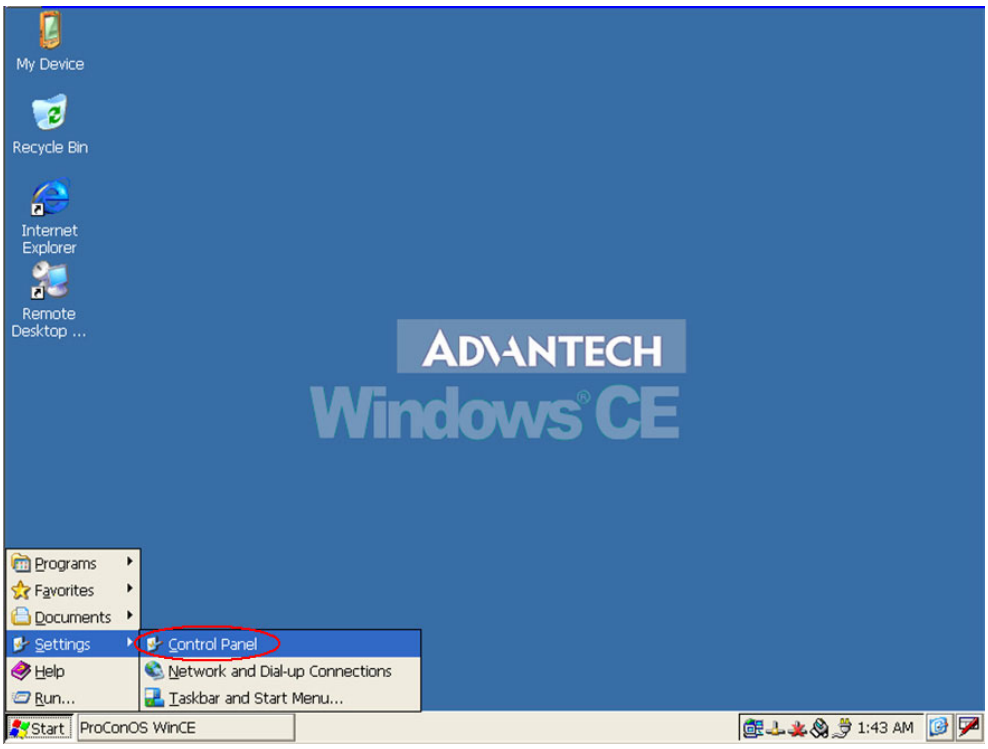
Version Information: Record installed software programs with respective version information. Chapter 4 has an example for reference.

All the utilities can be run by following path.

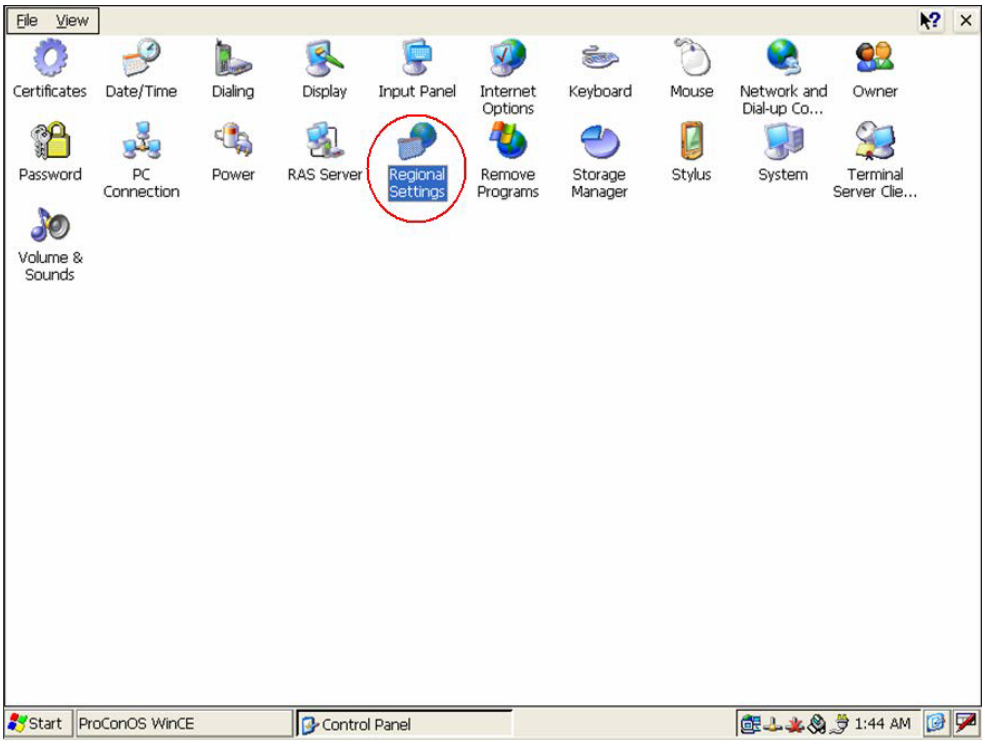


6.2 Change Language Interface of CE

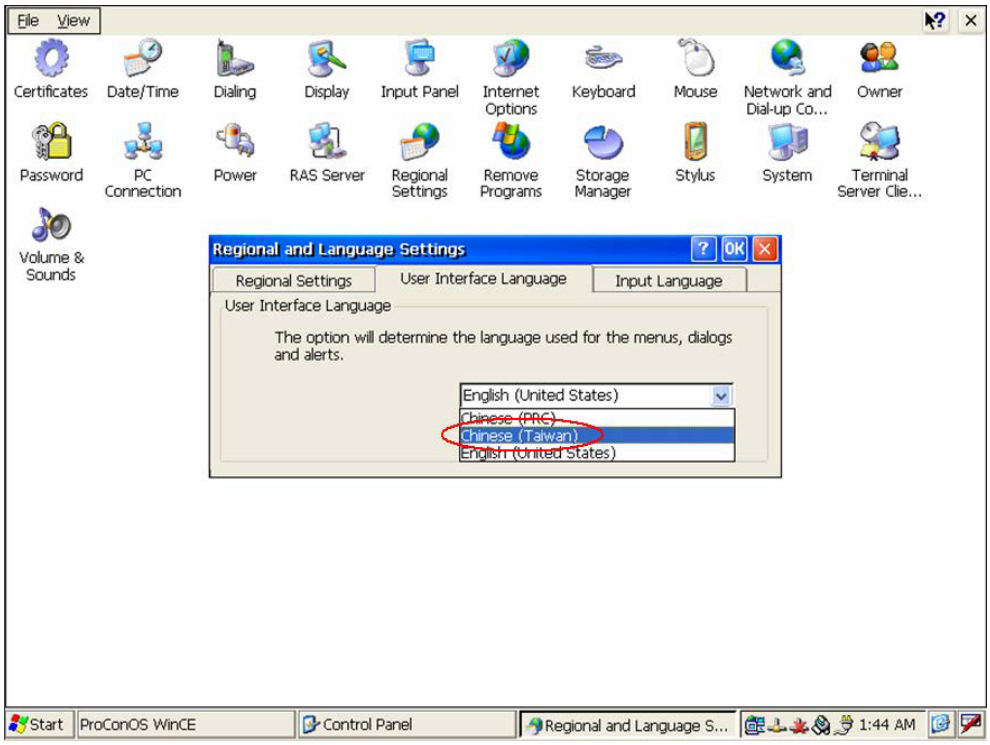
1. Enter “Control Panel”.



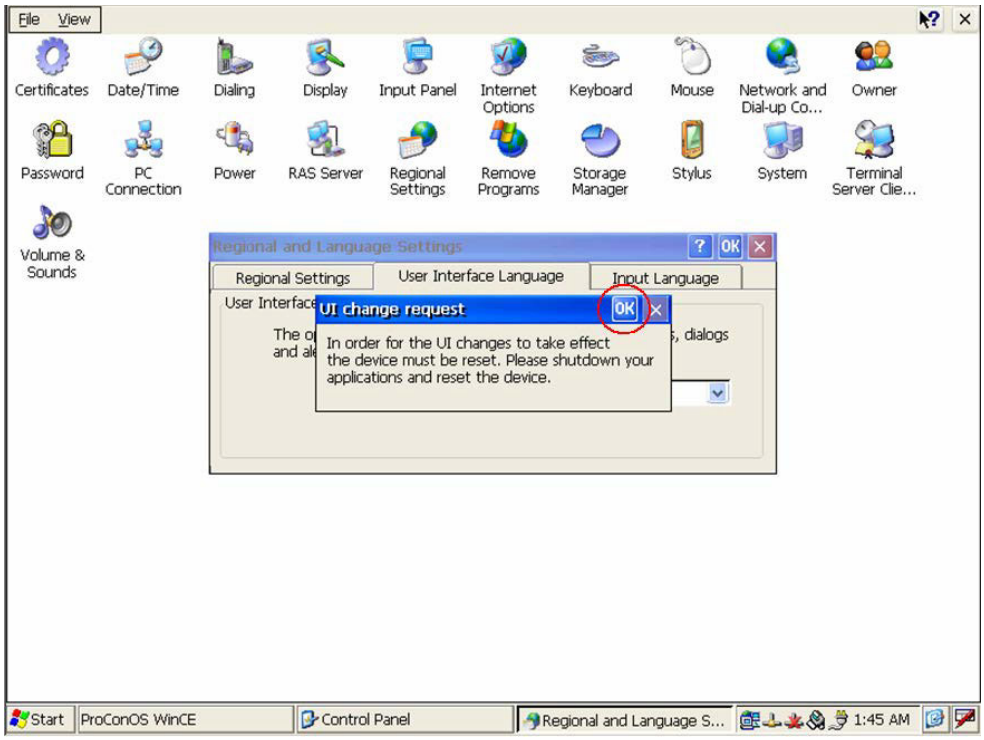
2. Run “Regional Settings”.



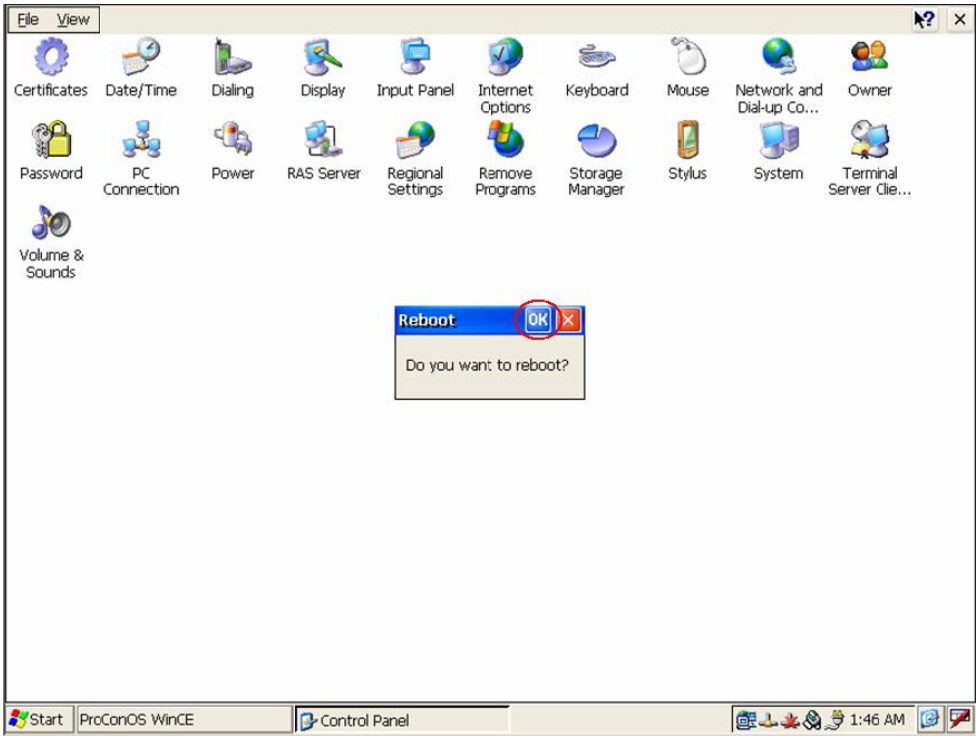
3. Click “User Interface Language” folder and select “Chinese (Taiwan)” item.



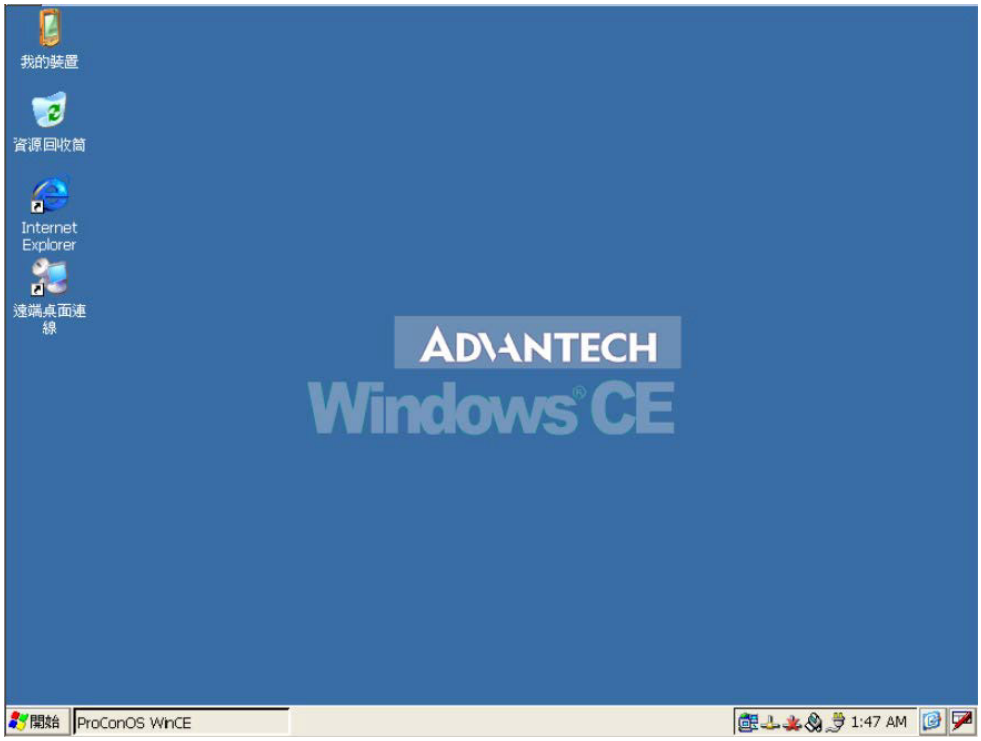
4. Click “OK” to finish the change.



5. Click “OK” to reboot the ADAM-5560.

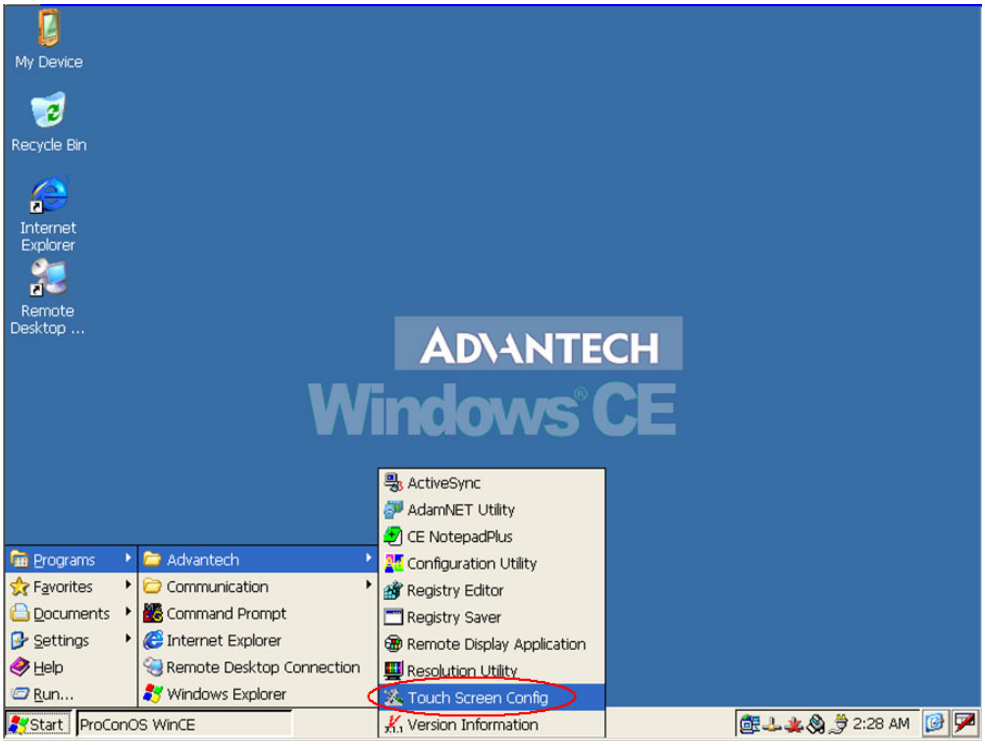


6. The Language Interface has been changed correctly.

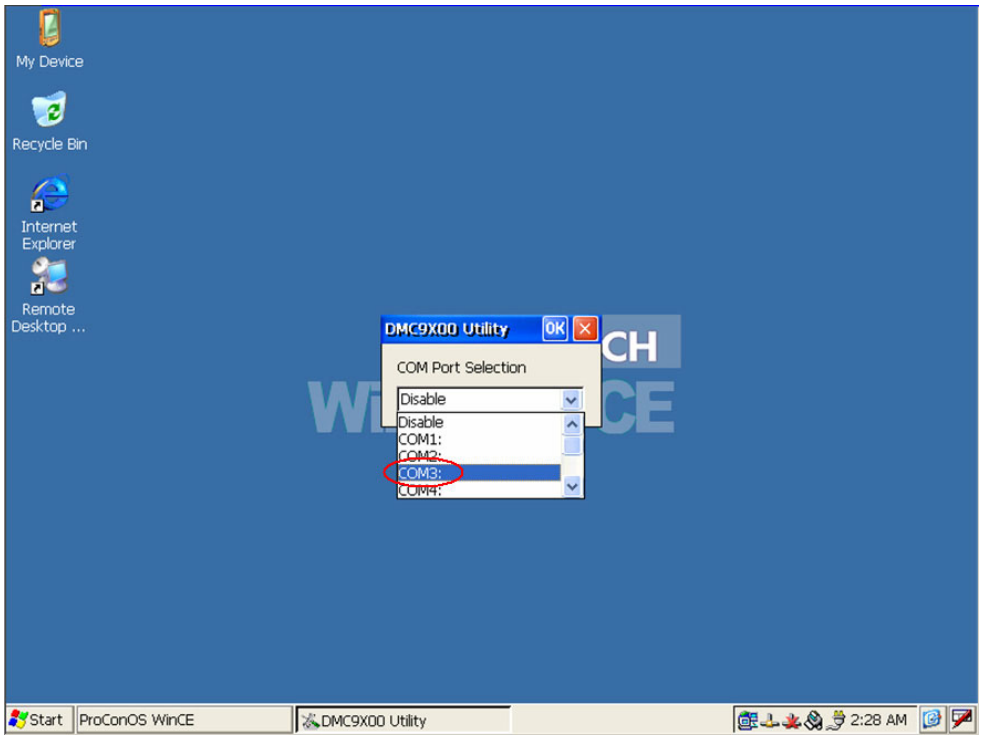


6.3 Example of Configuring Touch Screen

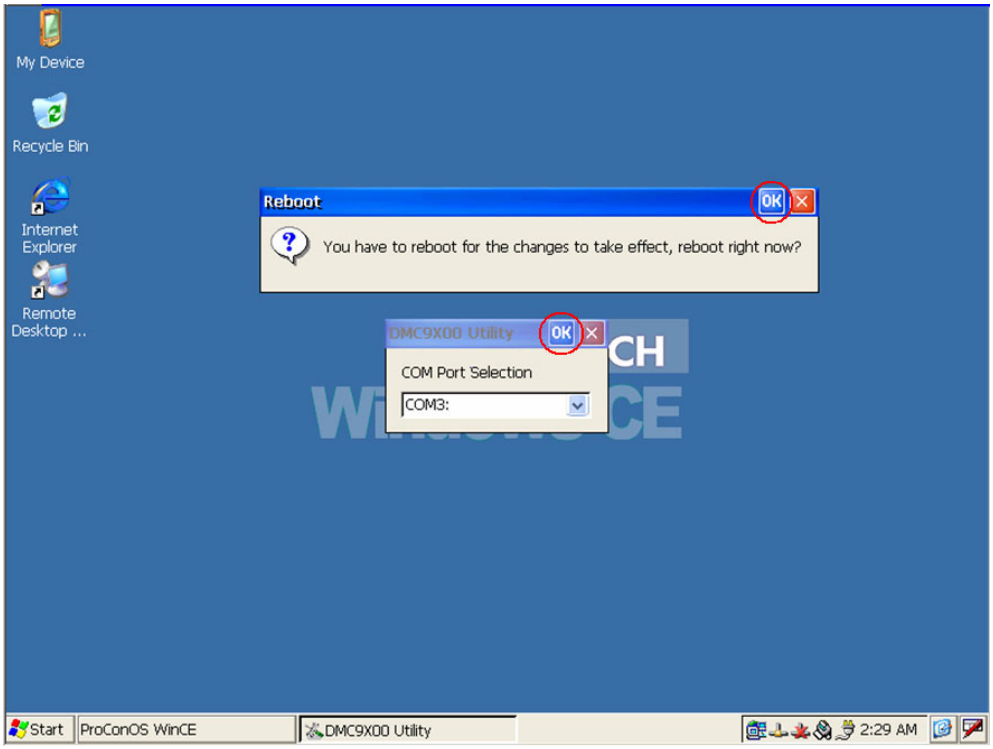
1. Run the “Touch Screen Config” utility.



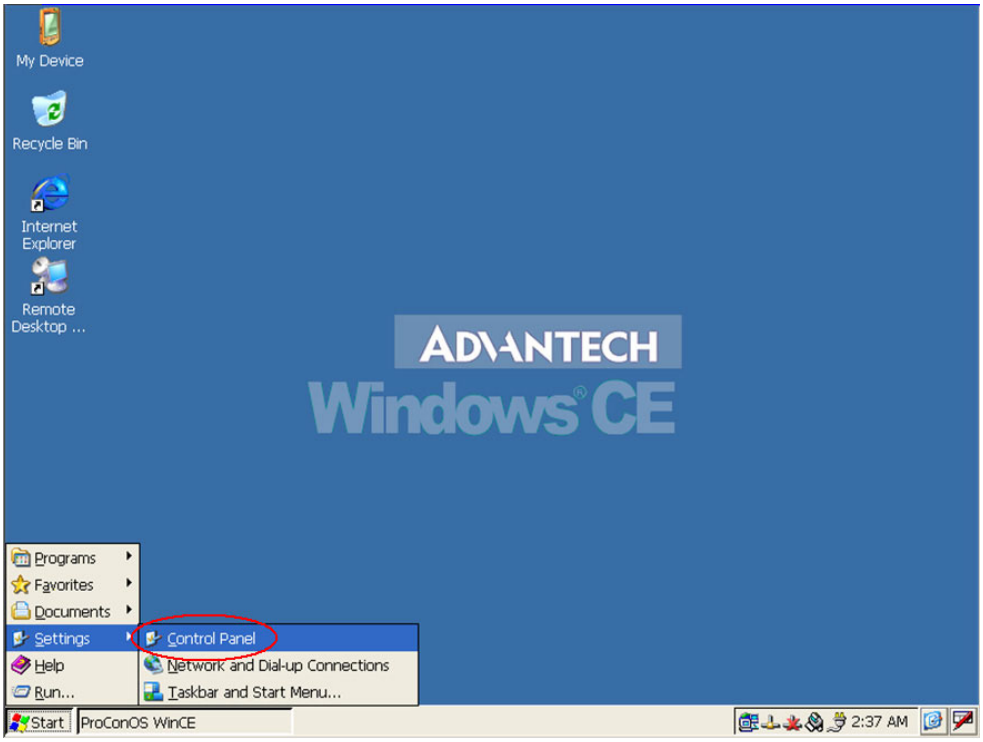
2. Select COM port as COM3, for example.



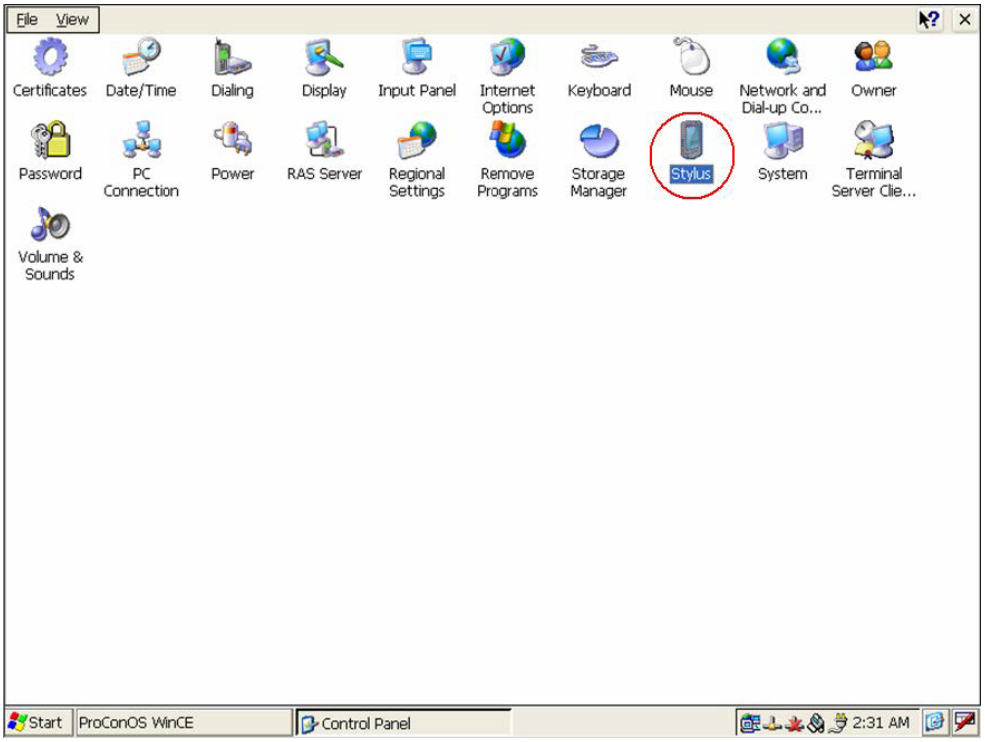
3. Click “OK” and reboot the ADAM-5560 system.



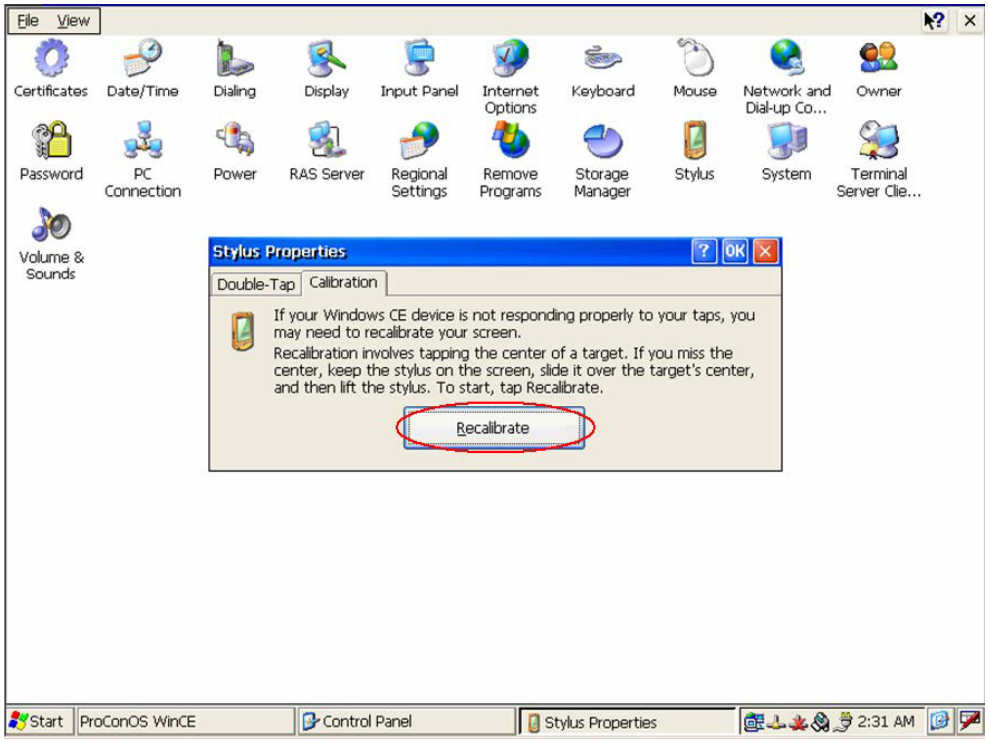
4. Enter “Control Panel”.



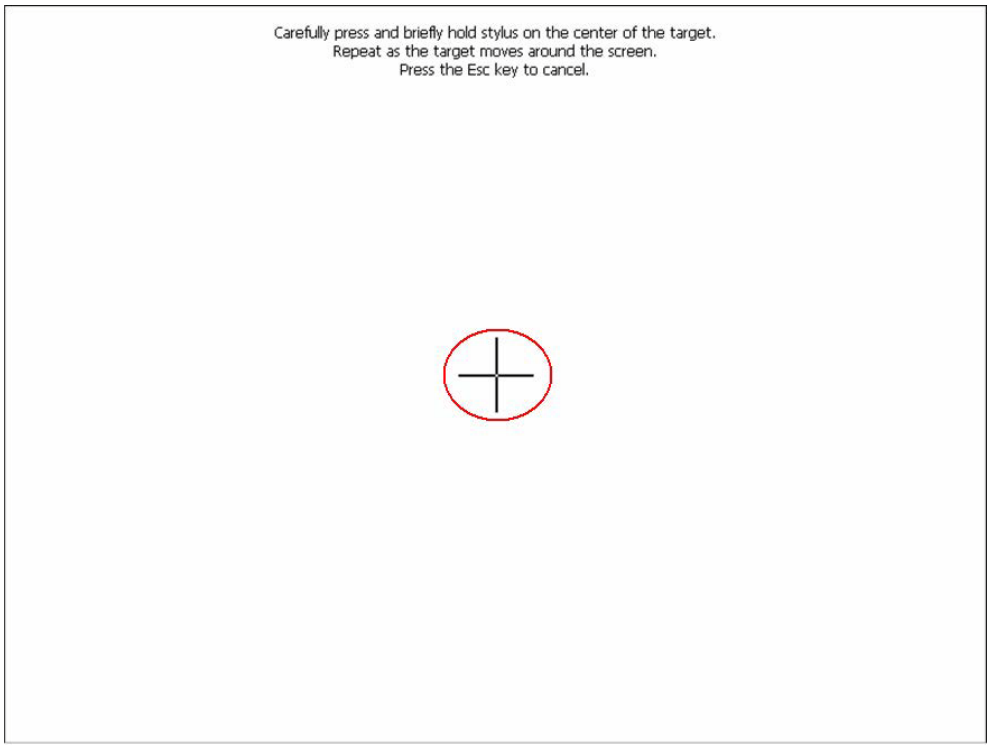
5. Run “Stylus” to set the properties.



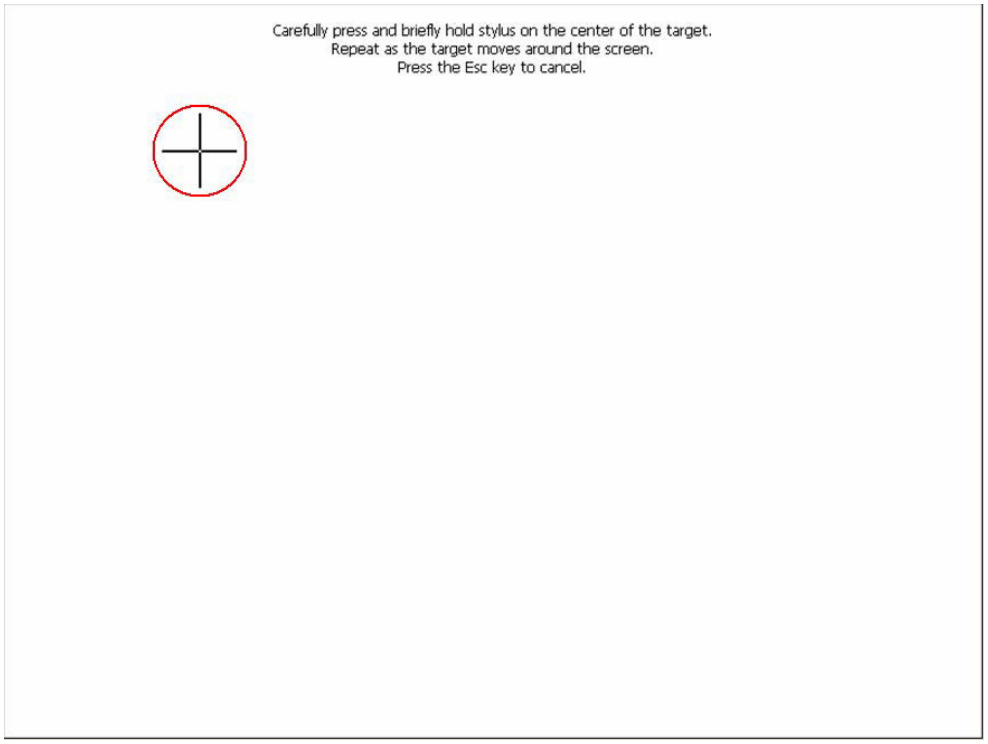
6. Click “Recalibrate” button.



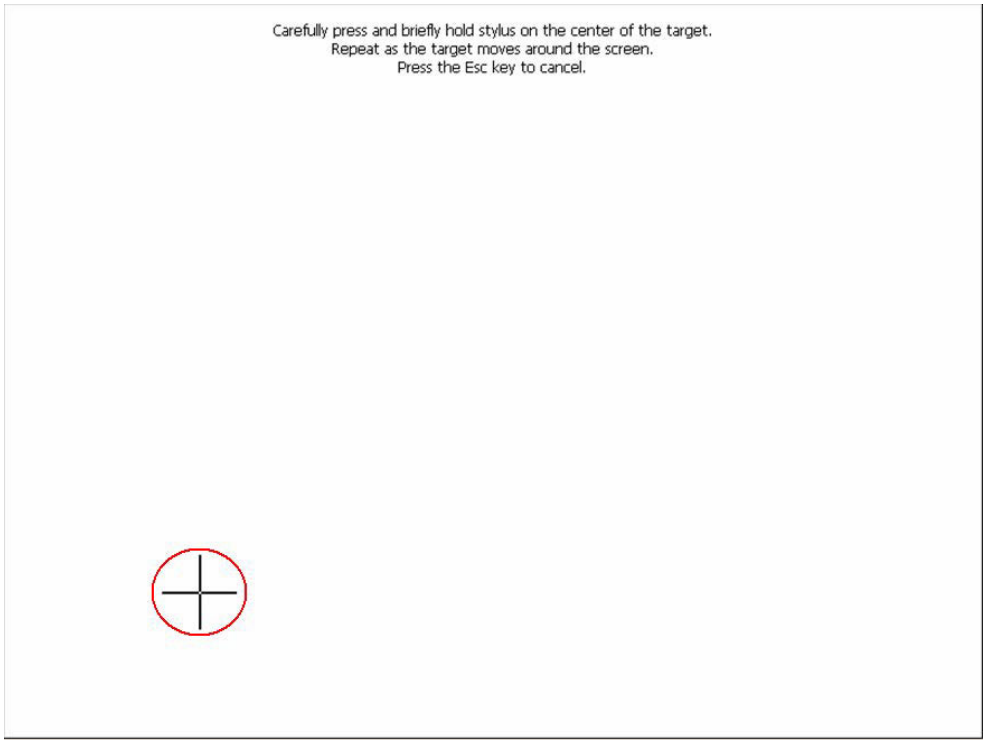
7. Follow the instructions and use finger to press the target on the screen.



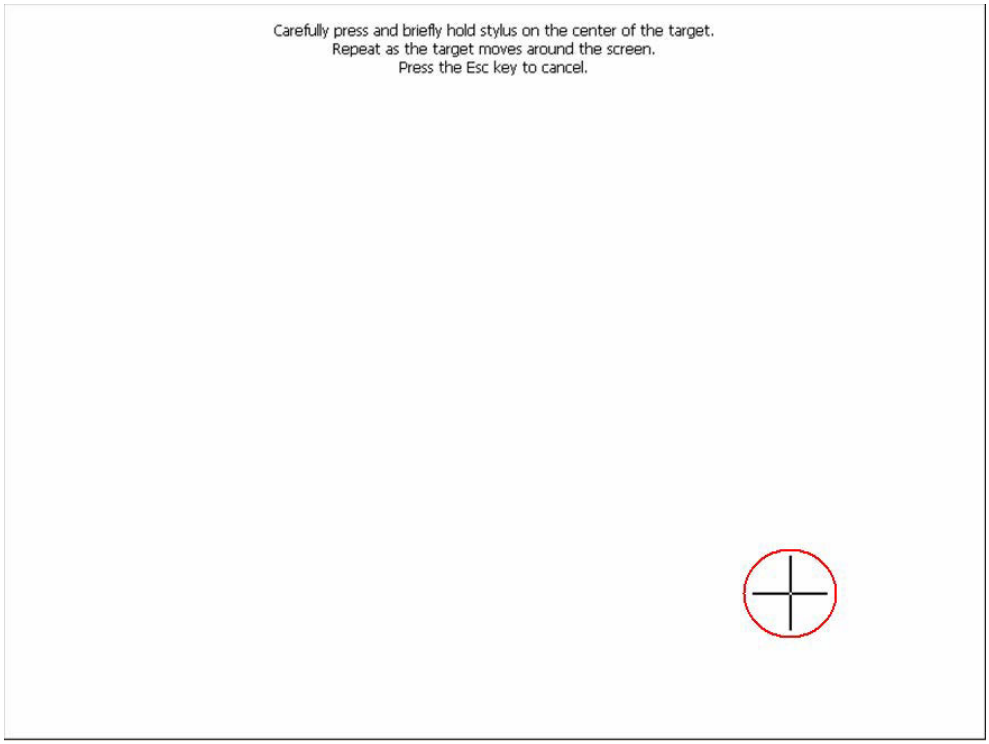
8. Follow the instructions and use finger to press the target on the screen.



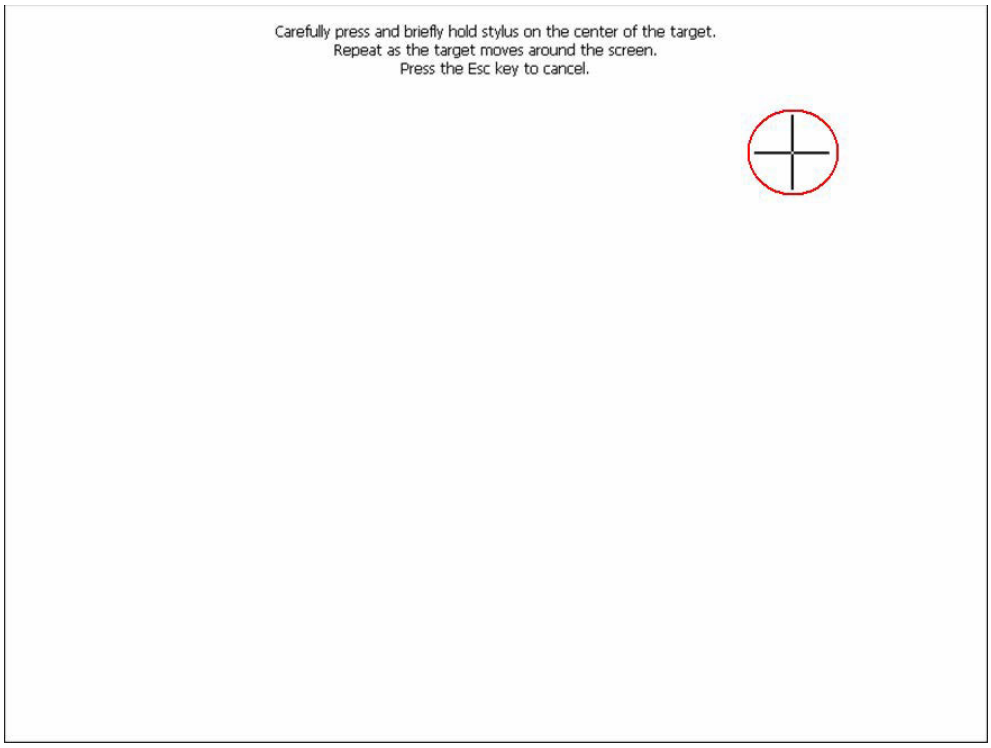
9. Follow the instructions and use finger to press the target on the screen.



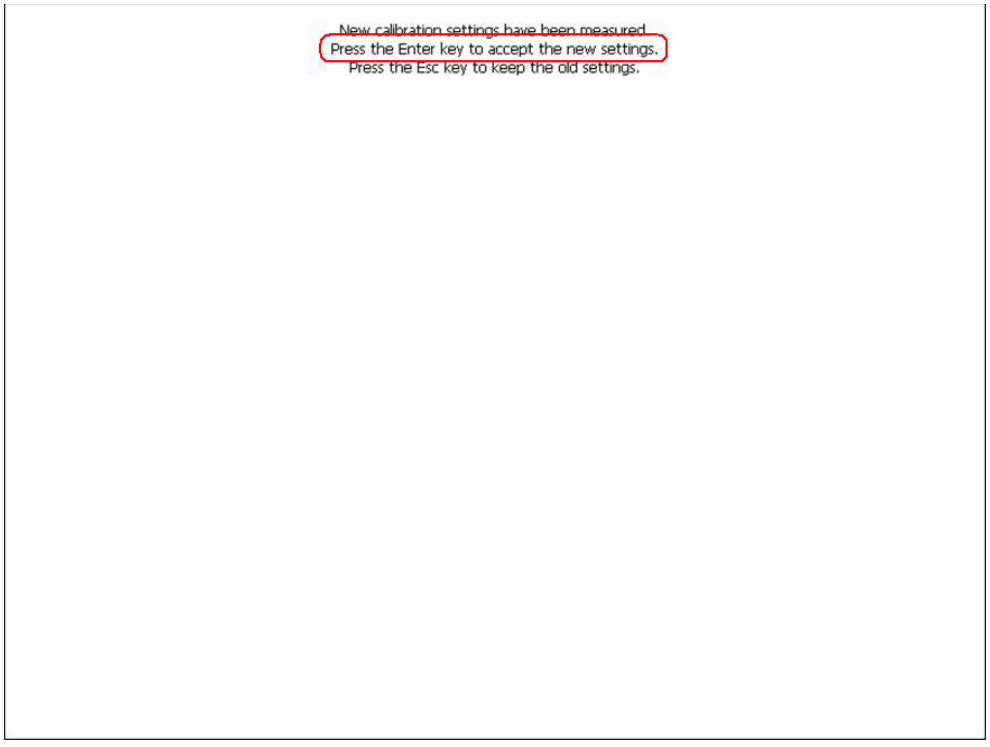
10. Follow the instructions and use finger to press the target on the screen.



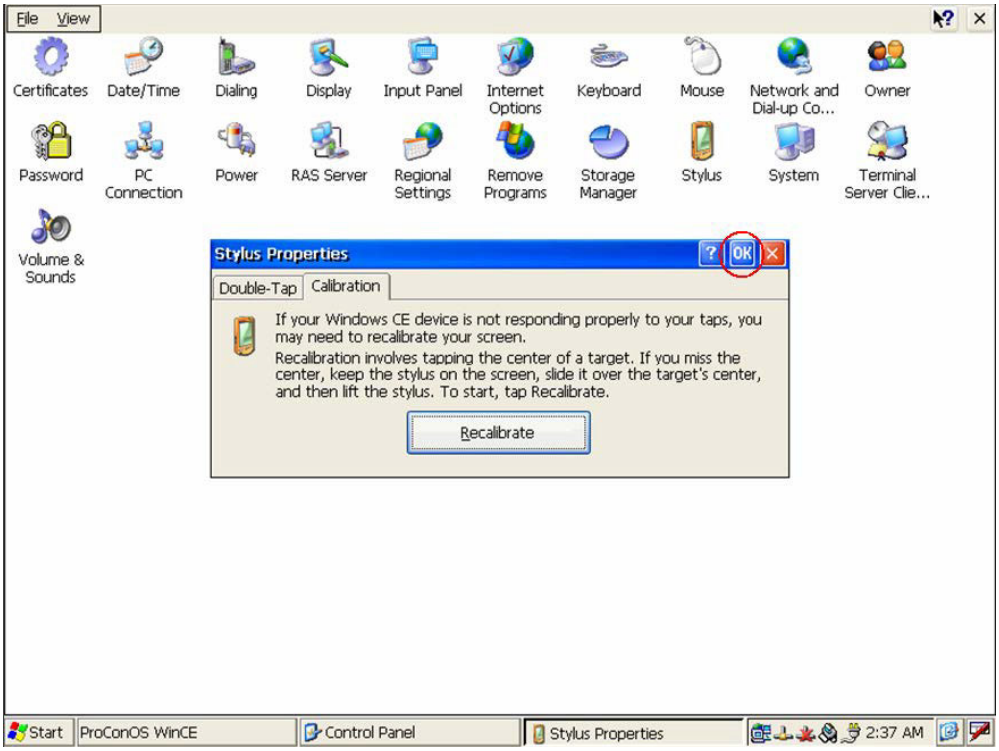
11. Follow the instructions and use finger to press the target on the screen.



12. Press “Enter” key to accept the new settings.

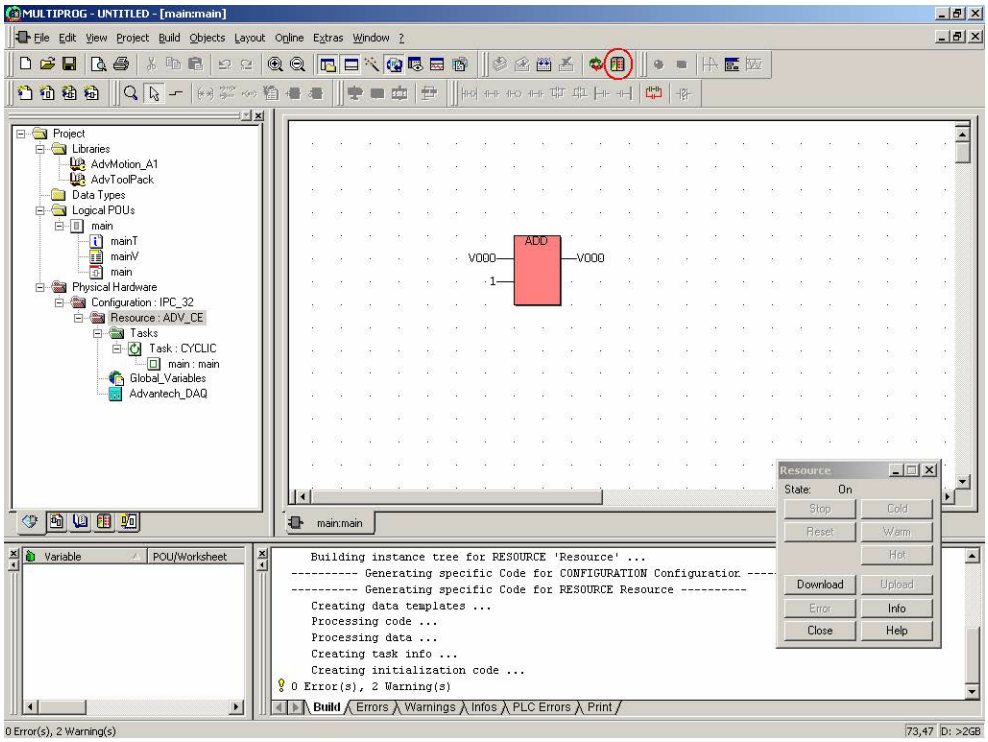


13. Click “OK” to finish the recalibration.

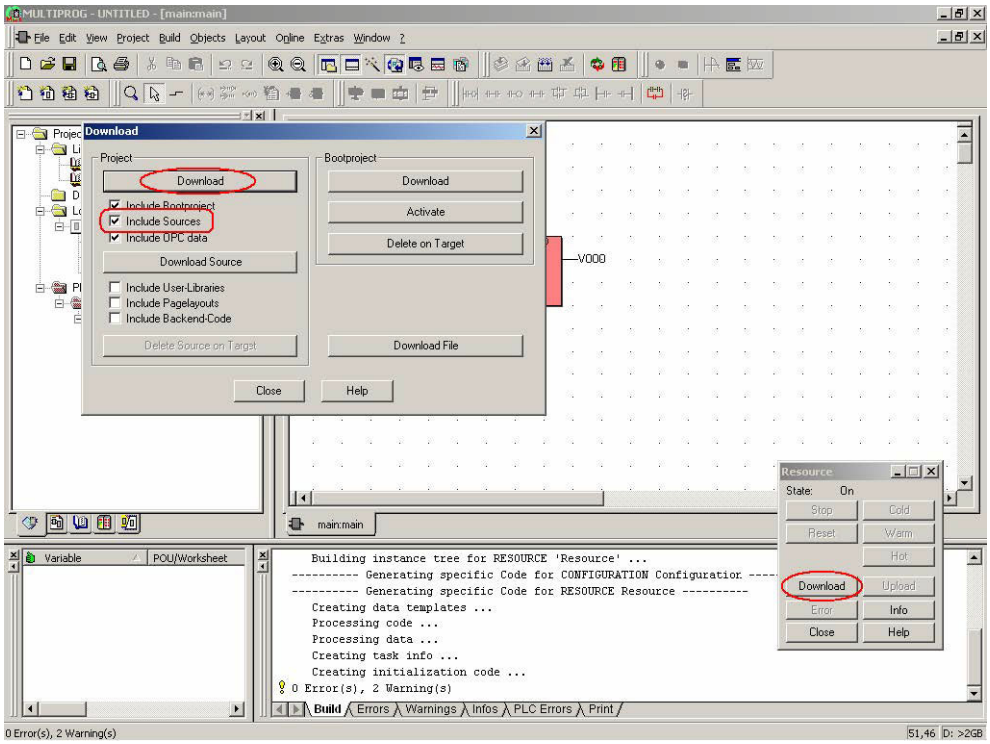


6.4 Save and Upload Project Source

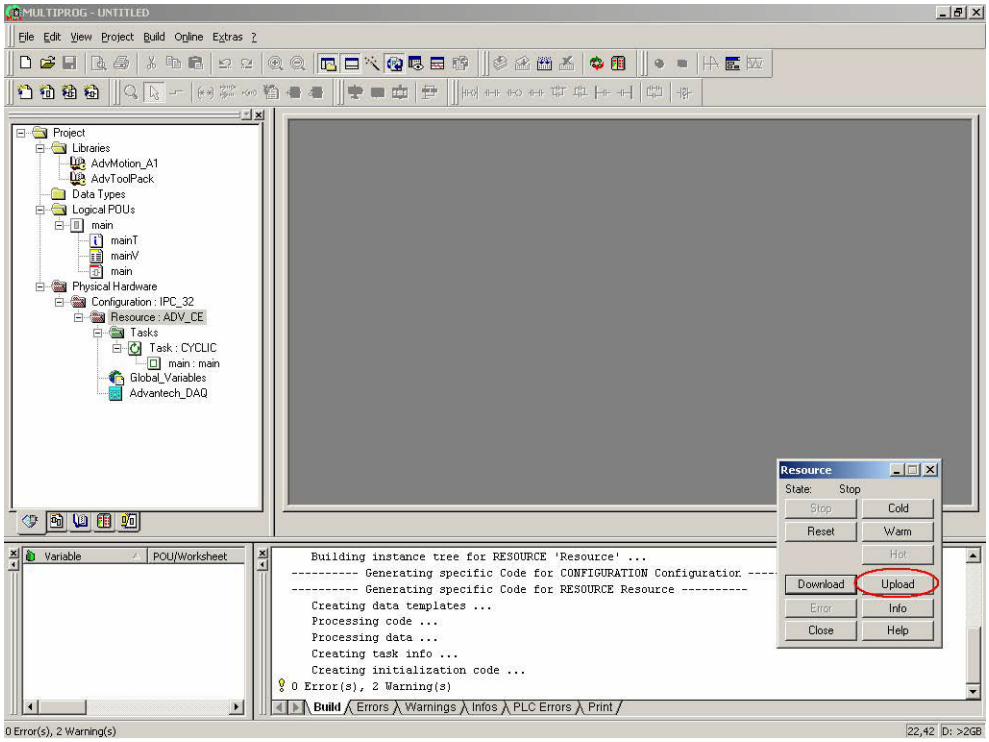
1. Open a project and click “Program Control Dialog”.



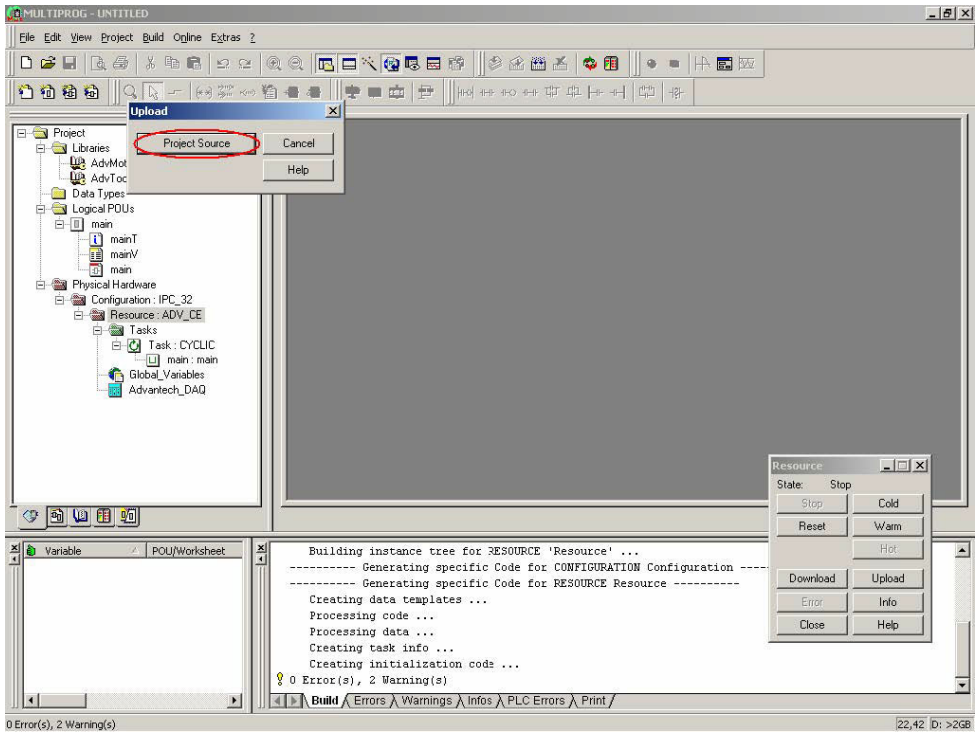
2. Click “Download” button. Check the “Include Sources” item and then click “Download”.



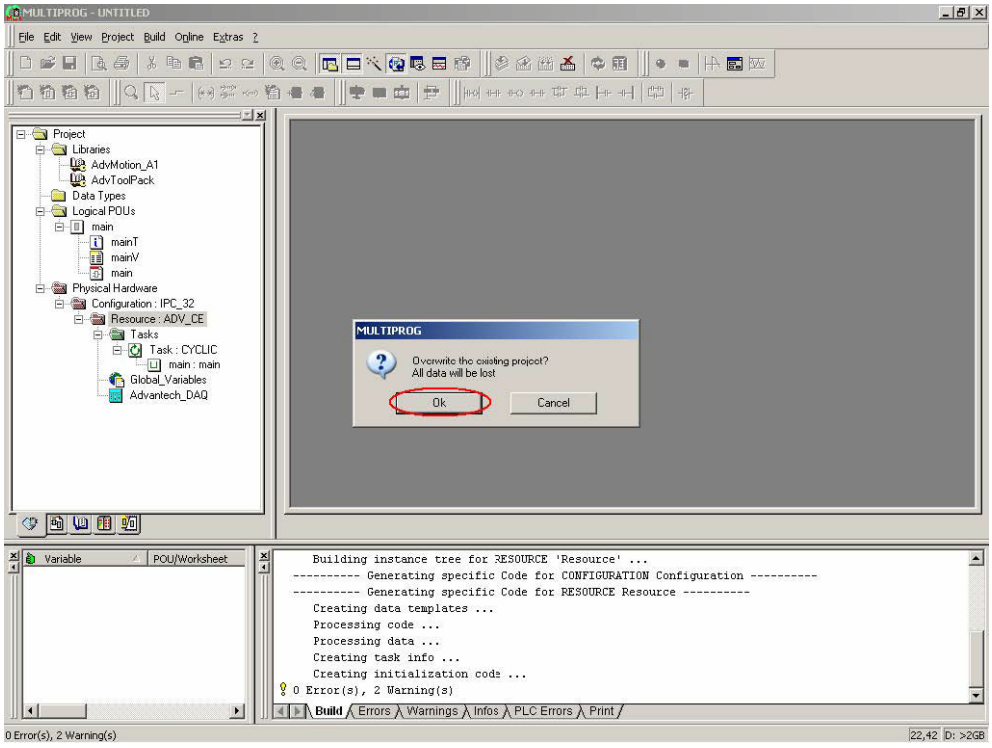
3. The “Upload” button will be activated when project source code has been downloaded correctly.



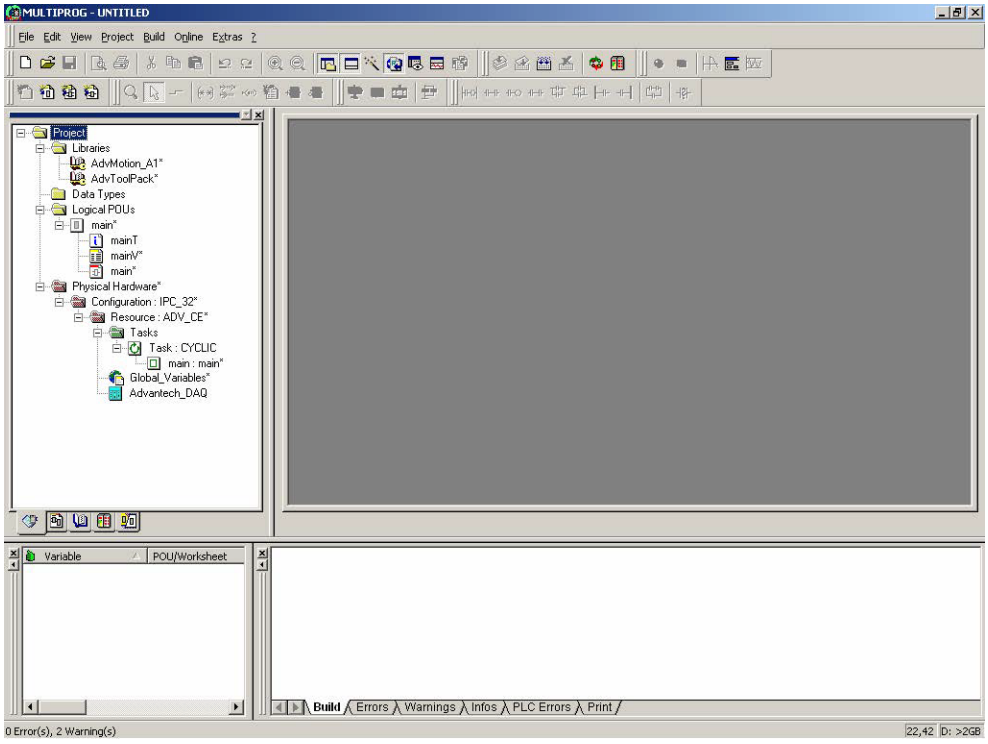
4. Click “Upload” button and then click “Project Source” to test uploading source function.



5. Click “OK” to proceed with uploading the project source.

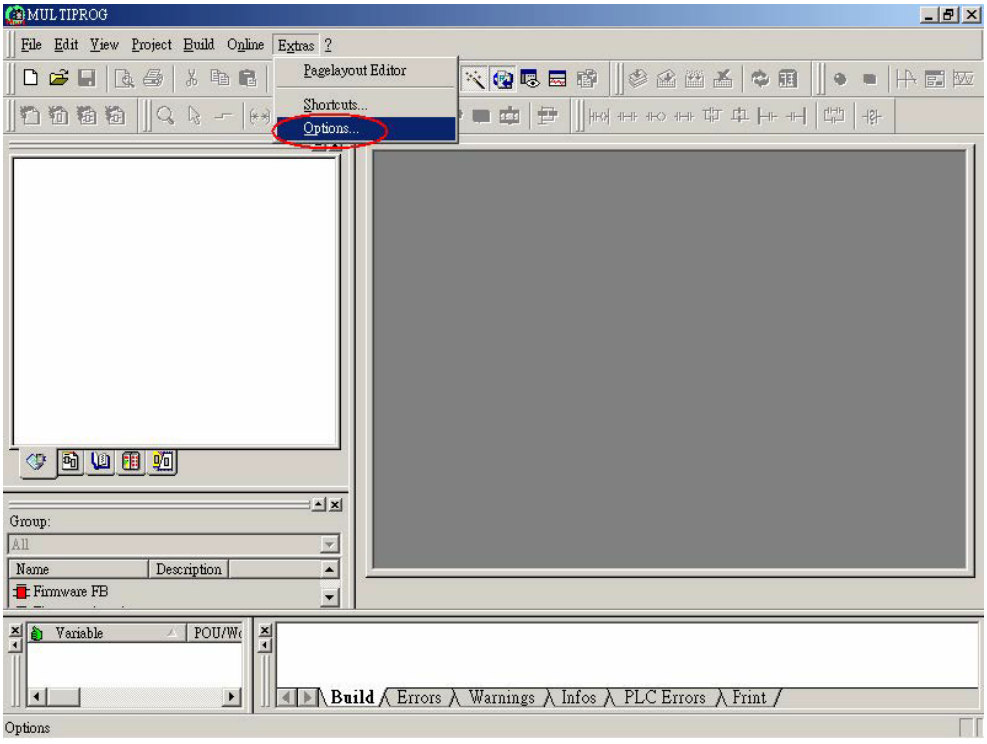


6. Uploading project source has been finished.

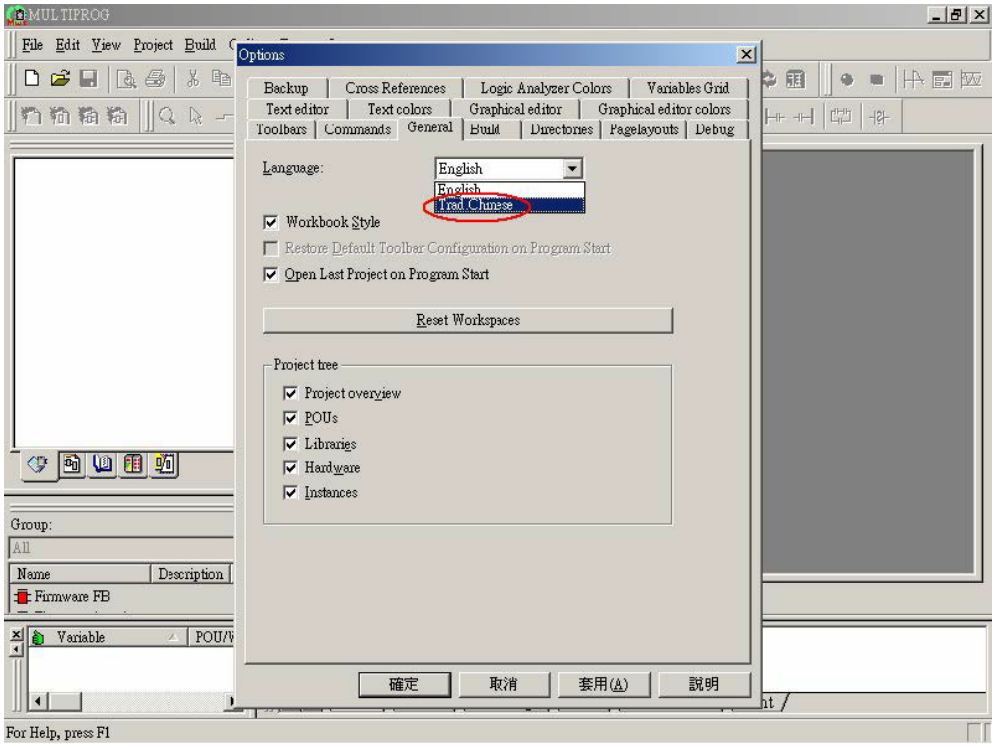


6.5 Changing the Language Interface

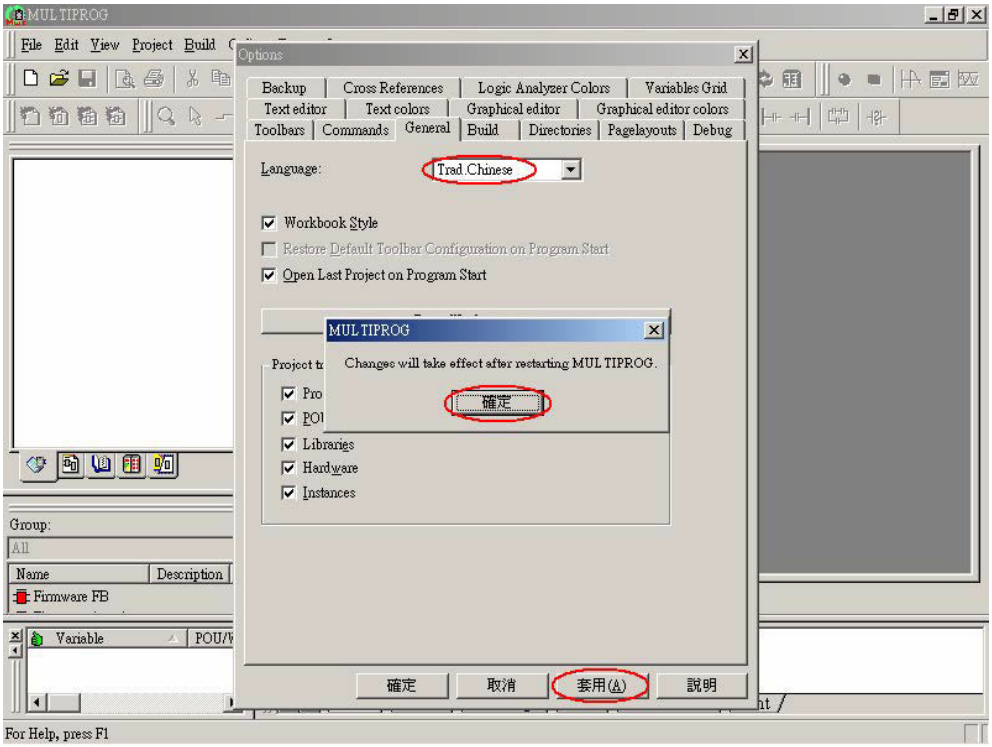
1. Click “Extras\Options” item.



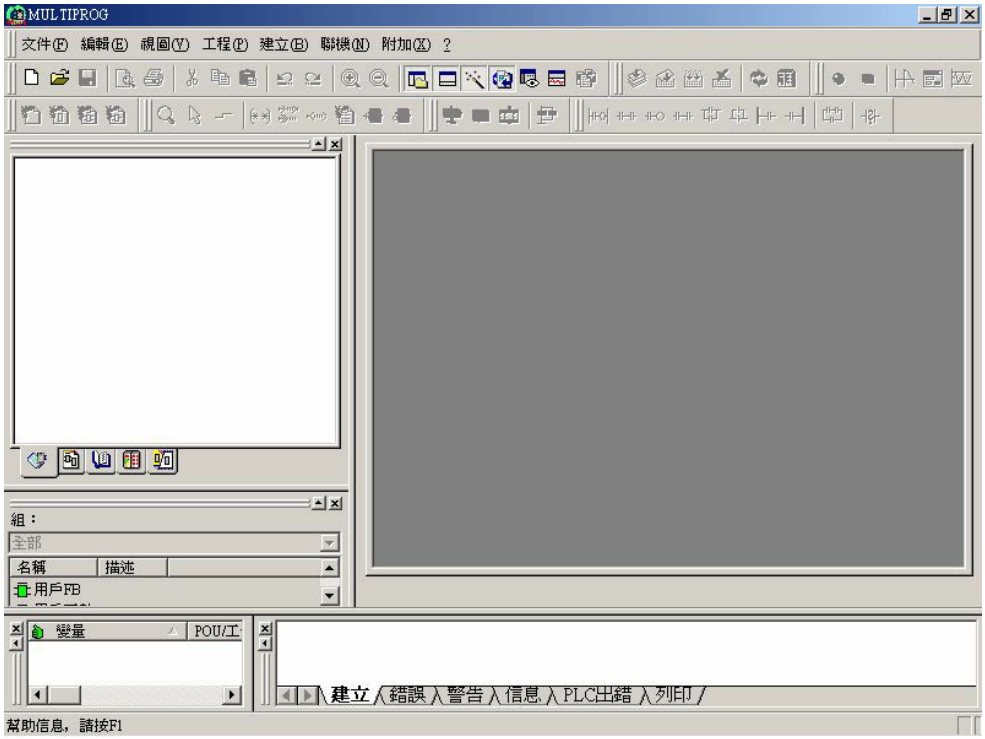
2. Select “Trad. Chinese” item.



3. Click “Apply” and “OK” buttons.



4. Close Multiprog and then reload it. The Language Interface will change to Traditional Chinese correctly.



Chapter A

RS-485 Networks

A.1 RS-485 Networks

EIA RS-485 is the industry's most widely used bidirectional, balanced transmission line standard. It is specifically developed for industrial multi-drop systems that should be able to transmit and receive data at high rates or over long distances.

The specifications of the EIA RS-485 protocol are as follows:

- Maximum line length per segment: 1200 meters (4000 feet)
- Throughput of 10 Mbaud and beyond -Differential transmission
- (balanced lines) with high resistance against noise
- Maximum 32 nodes per segment
- Bi-directional master-slave communication over a single set of twisted-pair cables
- Parallel connected nodes, true multi-drop

ADAM-5560 Series Controller is fully isolated and use just a single set of twisted pair wires to send and receive! Since the nodes are connected in parallel they can be freely disconnected from the host without affecting the functioning of the remaining nodes. An industry standard, shielded twisted pair is preferable due to the high noise ratio of the environment. When nodes communicate through the network, no sending conflicts can occur since a simple command/response sequence is used. There is always one initiator (with no address) and many slaves (with addresses). In this case, the master is a personal computer that is connected with its serial, RS-232, port to an ADAM RS-232/RS-485 converter. The slaves are the ADAM-5560 Series Controller. When systems are not transmitting data, they are in listen mode. The host computer initiates a command/response sequence with one of the systems. Commands normally contain the address of the module the host wants to communicate with. The system with the matching address carries out the command and sends its response to the host.

A.2 Basic Network Layout

Multi-drop RS-485 implies that there are two main wires in a segment. The connected systems tap from these two lines with so called drop cables. Thus all connections are parallel and connecting or discon- necting of a node doesn't affect the network as a whole. Since ADAM-5560 Series Controller use the RS-485 standard, they can connect and communicate with the host PC. The basic layouts that can be used for an RS-485 network are:

Daisychain

The last module of a segment is a repeater. It is directly connected to the main-wires thereby ending the first segment and starting the next segment. Up to 32 addressable systems can be daisychained . This limitation is a physical one. When using more systems per segment the IC driver current rapidly decreases, causing communication errors. In total, the network can hold up to 64 addressable systems. The limita- tion on this number is the two-character hexadecimal address code that can address 64 combinations. The ADAM converter, ADAM repeaters and the host computer are non addressable units and therefore are not included in these numbers.

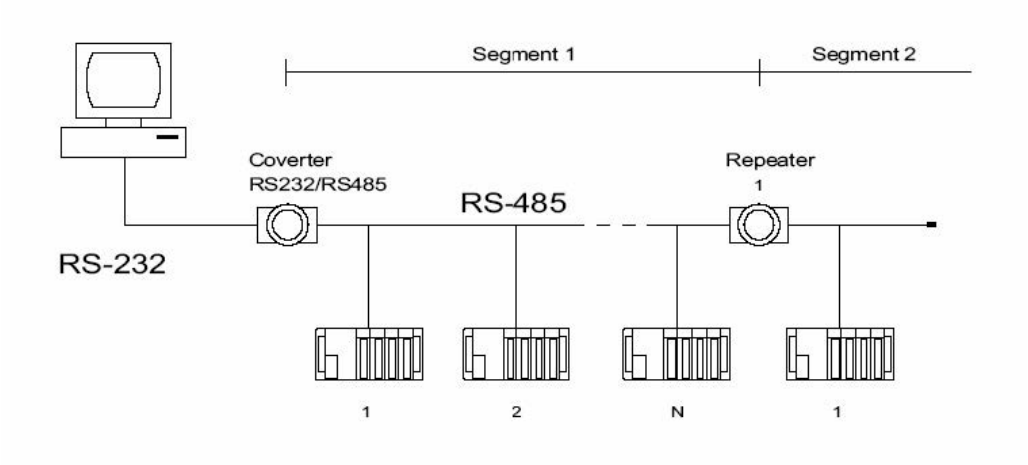


Figure A.1 Daisychaining

Star Layout

In this scheme the repeaters are connected to drop-down cables from the main wires of the first segment. A tree structure is the result. This scheme is not recommended when using long lines since it will cause a serious amount of signal distortion due to signal reflections in several line-endings.

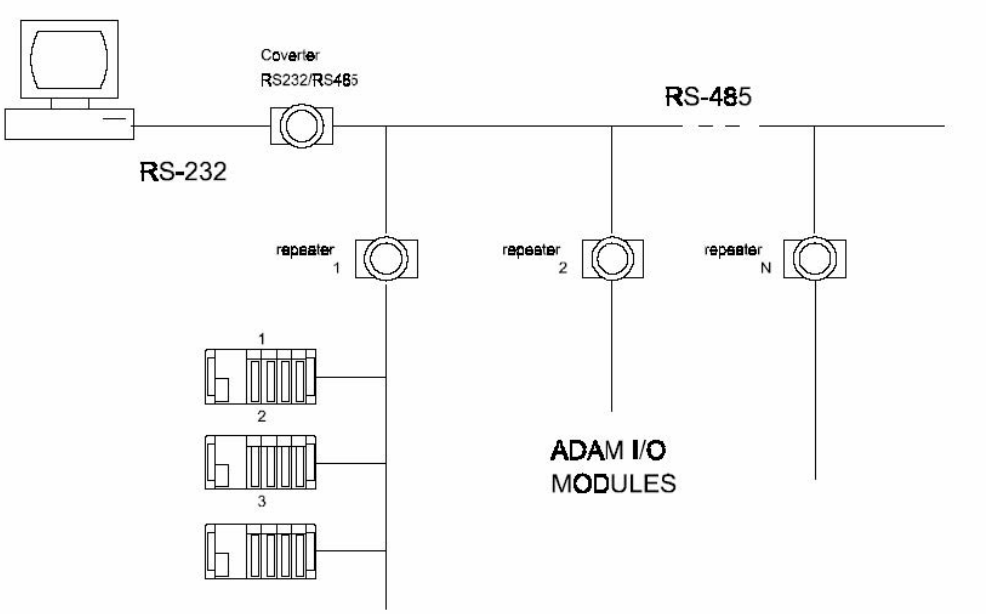


Figure A.2 Star Structure

Random

This is a combination of daisychain and hierarchical structure.

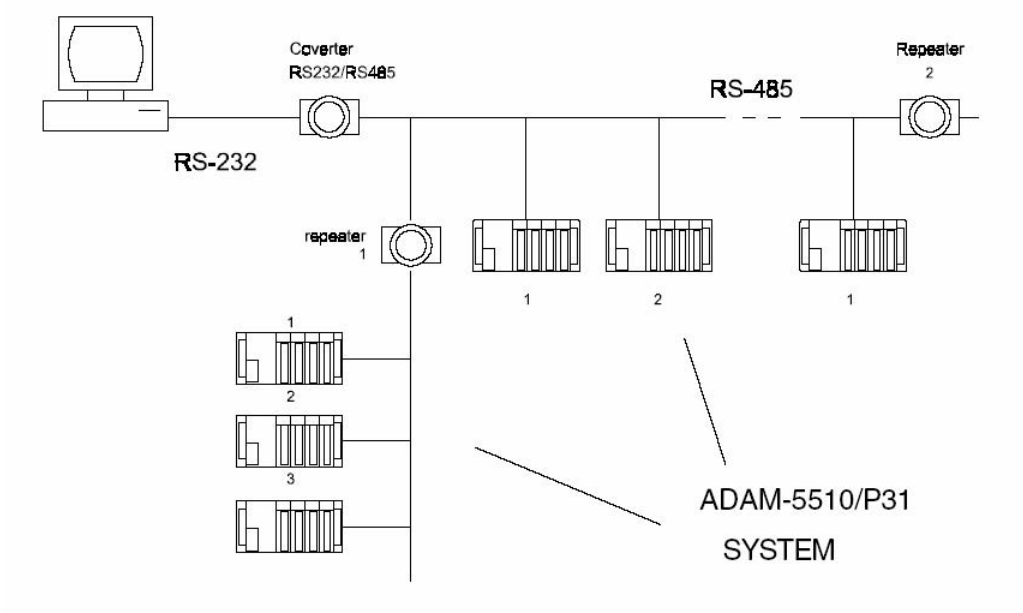


Figure A.3 Random structure

A.3 Line Termination

Each discontinuity in impedance causes reflections and distortion. When a impedance discontinuity occurs in the transmission line the immediate effect is signal reflection. This will lead to signal distortion. Specially at line ends this mismatch causes problems. To eliminate this discontinuity, terminate the line with a resistor.

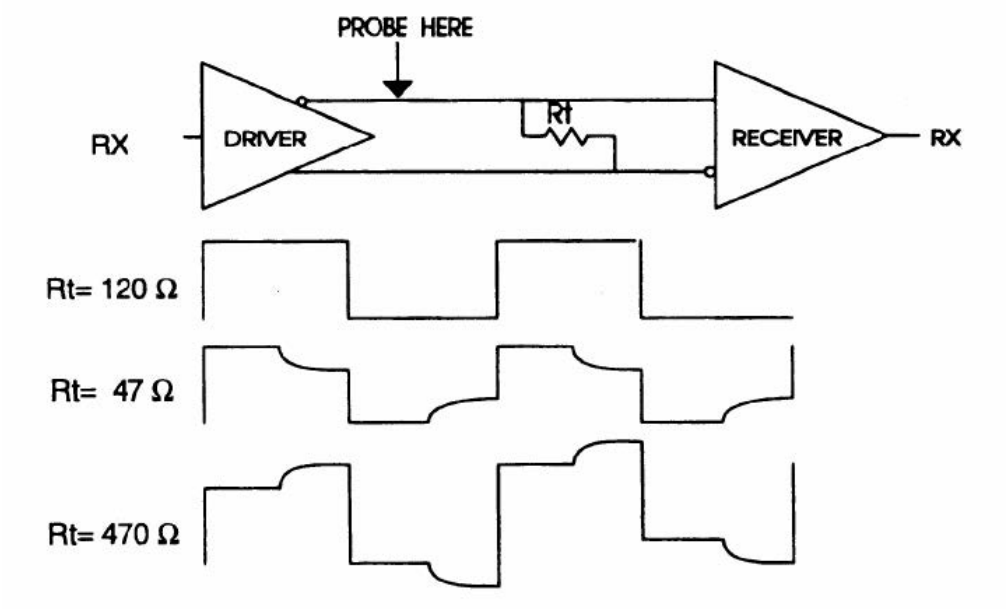


Figure A.4 Signal Distortion

The value of the resistor should be a close as possible to the charac- teristic impedance of the line. Although receiver devices add some resistance to the whole of the transmission line, normally it is sufficient to the resistor impedance should equal the characteristic impedance of the line.

Example: Each input of the receivers has a nominal input impedance of 18 k feeding into a diode transistor- resistor biasing network that is equivalent to an 18 k input resistor tied to a common mode voltage of 2.4 V. It is this configuration, which provides the large common range of the receiver required for RS-485 systems! (See Figure D-5 below).

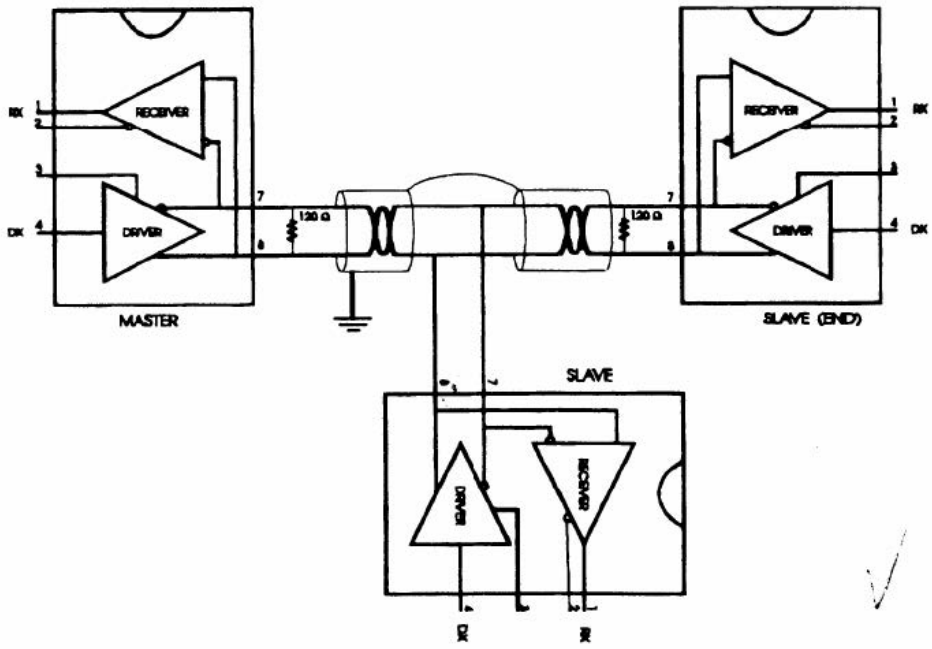


Figure A.5 Termination Resistor Locations

Because each input is biased to 2.4 V, the nominal common mode voltage of balanced RS-485 systems, the 18 k on the input can be taken as being in series across the input of each individual receiver. If thirty of these receivers are put closely together at the end of the transmission line, they will tend to react as thirty 36k resistors in parallel with the termination resistor. The overall effective resistance will need to be close to the characteristics of the line. The effective parallel receiver resistance RP will therefore be equal to:

$R_P = 36 \times 10^3/30 = 1200\Omega$

While the termination receptor RT will equal:

$R_T = R_O / [1 - R_O/R_P]$

Thus for a line with a characteristic impedance of 100 resistor $R_T = 100/[1 - 100/1200] = 110\Omega$

Since this value lies within 10% of the line characteristic impedance.

Thus as already stated above the line termination resistor RT will normally equal the characteristic impedance Z_0. The star connection causes a multitude of these discontinuities since there are several transmission lines and is therefore not recommend.

Note! *The recommend method wiring method, that causes a minimum amount of reflection, is daisy chaining where all receivers tapped from one transmission line needs only to be terminated twice.*

A.4 RS-485 Data Flow Control

The RS-485 standard uses a single pair of wires to send and receive data. This line sharing requires some method to control the direction of the data flow. RTS (Request To Send) and CTS (Clear To Send) are the most commonly used methods.

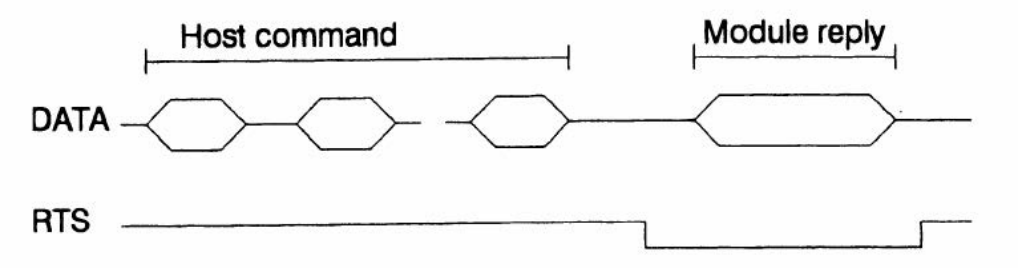


Figure A.6 RS-485 Data Flow Control with RTS

Intelligent RS-485 Control

ADAM-4510 and ADAM-4520 are both equipped with an I/O circuit which can automatically sense the direction of the data flow. No handshaking with the host (like RTS, Request to Send) is necessary to receive data and forward it in the correct direction. You can use any software written for half-duplex RS-232 with an ADAM network without modification. The RS-485 control is completely transparent to the user.

Chapter B

Grounding Reference

B.1 Field Grounding and Shielding Applications

Unfortunately, it's impossible to finish a system integration task at one time. We always meet some trouble in the field. A communication network or system isn't stable, induced noise or equipment is damaged or there are storms. However, the most usual issue is just simply improper wiring, ie, grounding and shielding. You know the 80/20 rule in our life: we spend 20% time for 80% work, but 80% time for the last 20% of the work. So is it with system integration: we pay 20% for Wire / Cable and 0% for Equipment. However, 80% of reliability depends on Grounding and Shielding. In other words, we need to invest more in that 20% and work on these two issues to make a highly reliable system. This application note brings you some concepts about field grounding and shielding. These topics will be illustrated in the following pages.

B.2 Grounding

B.2.1 The 'Earth' for reference

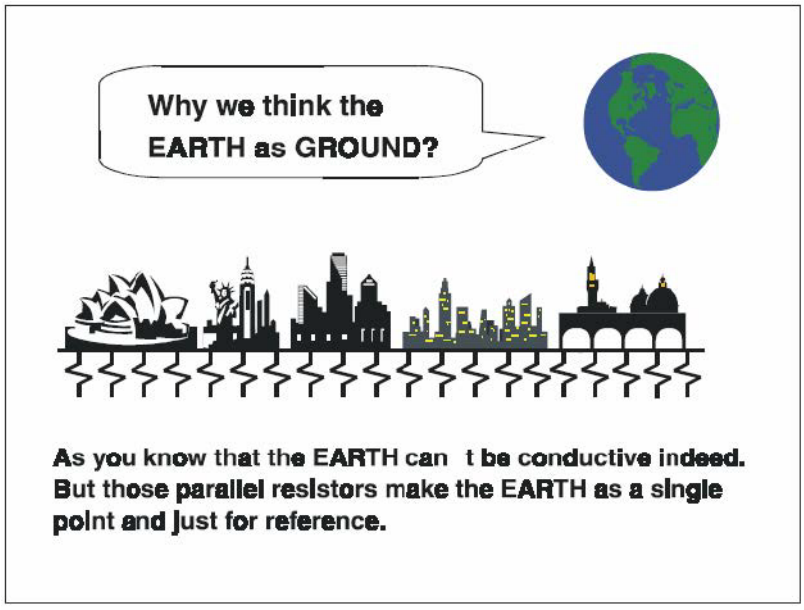


Figure B.1 Think the EARTH as GROUND

As you know, the EARTH cannot be conductive. However, all build- ings lie on, or in, the EARTH. Steel, concrete and associated cables (such as lighting arresters) and power system were connected to EARTH. Think of them as resistors. All of those infinite parallel resistors make the EARTH as a single reference point.

B.2.2 The 'Frame Ground' and 'Grounding Bar'

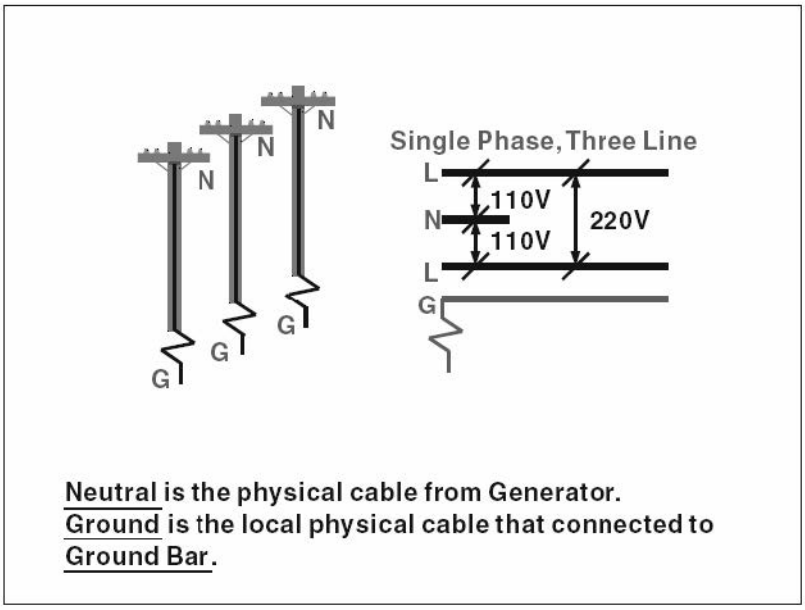


Figure B.2 Grounding Bar

Grounding is one of the most important issues for our system. Just like Frame Ground of the computer, this signal offers a reference point of the electronic circuit inside the computer. If we want to communicate with this computer, both Signal Ground and Frame Ground should be connected to make a reference point of each other's electronic circuit. Generally speaking, it is necessary to install an individual grounding bar for each system, such as computer networks, power systems, tele-communication networks, etc. Those individual grounding bars not only provide the individual reference point, but also make the earth a our ground!

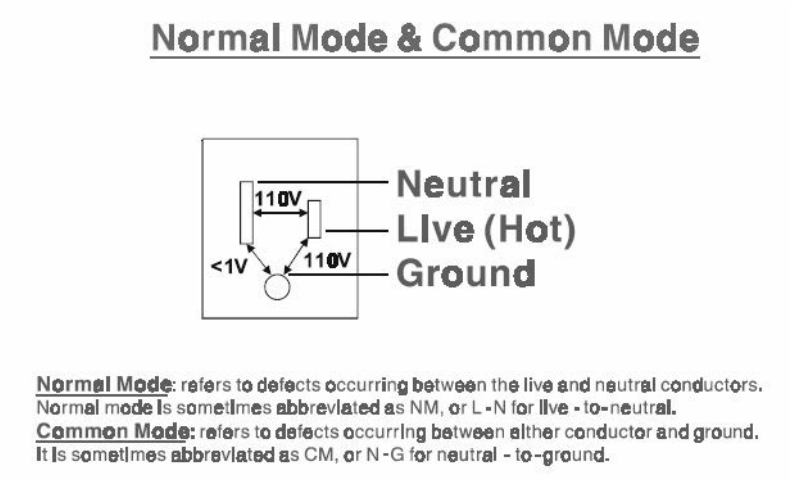


Figure B.3 Normal and Common Modes

B.2.3 Normal Mode and Common Mode

Have you ever tried to measure the voltage between a live circuit and a concrete floor? How about the voltage between neutral and a concrete floor? You will get non-sense values. 'Hot' and 'Neutral' are just relational signals: you will get 110VAC or 220VAC by measuring these signals. Normal mode and common mode just show you that the Frame Ground is the most important reference signal for all the systems and equipments.

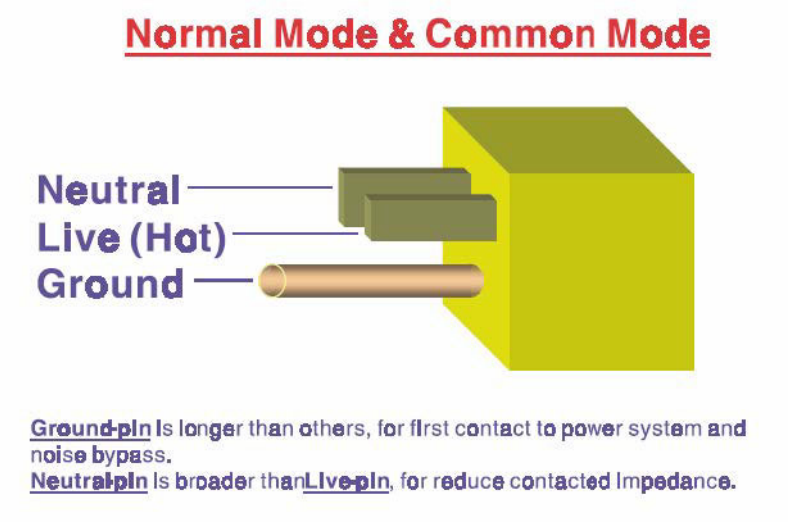


Figure B.4 Normal and Common Modes

- Ground-pin is longer than others, for first contact to power system and noise bypass.
- Neutral-pin is broader than Live-pin, for reducing contact imped- ance.

B.2.4 Wire Impedance

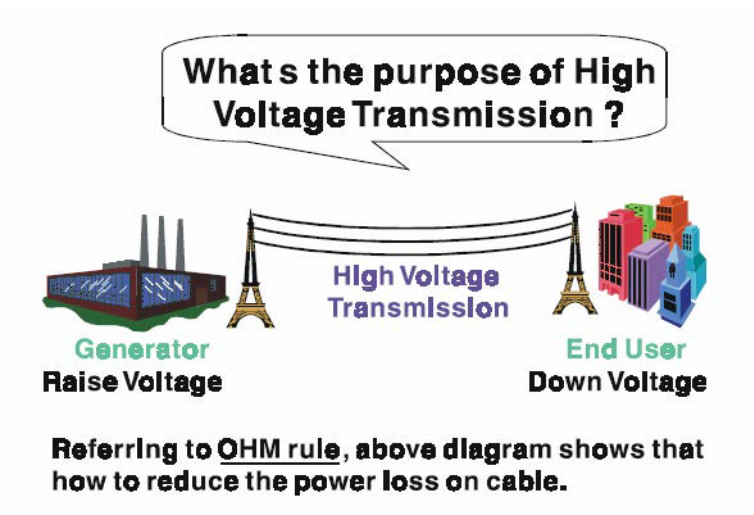


Figure B.5 High Voltage Transmissions

What's the purpose of high voltage transmissions? We have all seen high voltage transmission towers. The power plant raises the voltage while generating the power, then a local power station steps down the voltage. What is the purpose of high voltage transmission wires ? According to the energy formula, P = V * I, the current is reduced when the voltage is raised. As you know, each cable has impedance because of the metal it is made of. Referring to Ohm's Law, (V = I * R) this decreased current means lower power losses in the wire. So, high voltage lines are for reducing the cost of moving electrical power from one place to another.

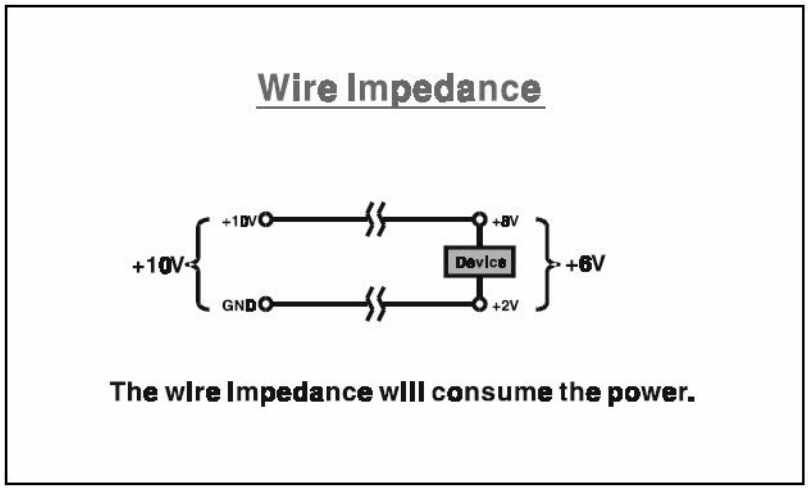


Figure B.6 Wire Impedance

B.2.5 Single Point Grounding

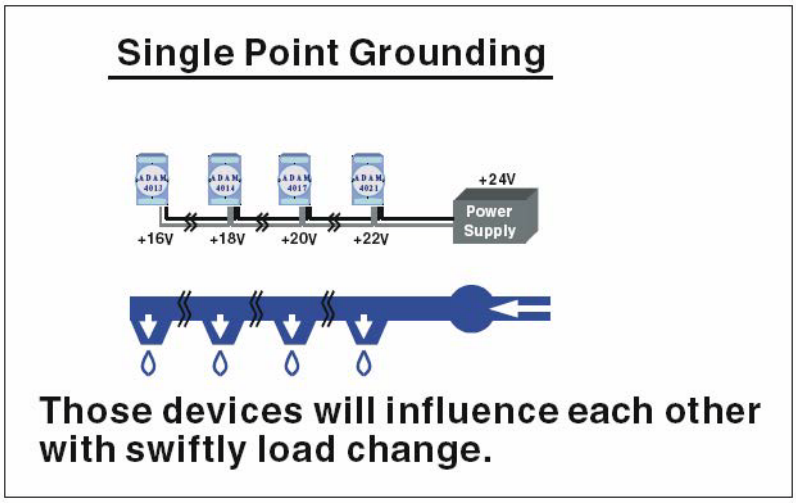


Figure B.7 Single Point Grounding (1)

What's Single Point Grounding? Maybe you have had an unpleasant experience while taking a hot shower in Winter. Someone turns on a hot water faucet somewhere else. You will be impressed with the cold water! The bottom diagram above shows an example of how devices will influence each other with swift load change. For example, normally we turn on all the four hydrants for testing. When you close the hydrant 3 and hydrant 4, the other two hydrants will get more flow. In other words, the hydrant cannot keep a constant flow rate.

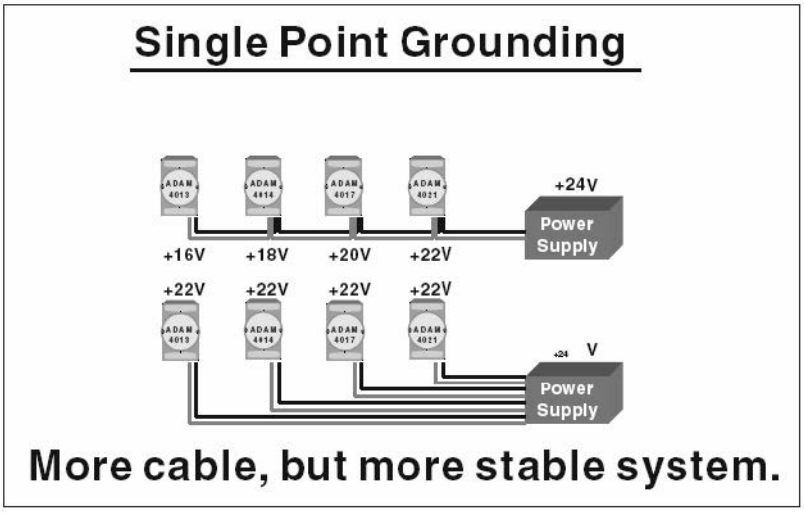


Figure B.8 Single Point Grounding (2)

The above diagram shows you that a single point grounding system will be a more stable system. If you use thin cable for powering these devices, the end device will actually get lower power. The thin cable will consume the energy.

B.3 Shielding

B.3.1 Cable Shield

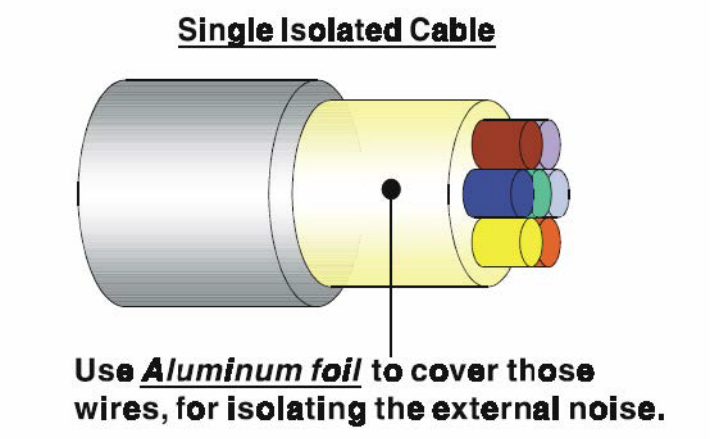


Figure B.9 Single Isolated Cable

Single isolated cable The diagram shows the structure of an isolated cable. You see the isolated layer which is spiraled Aluminum foil to cover the wires. This spiraled structure makes a layer for shielding the cables from external noise.

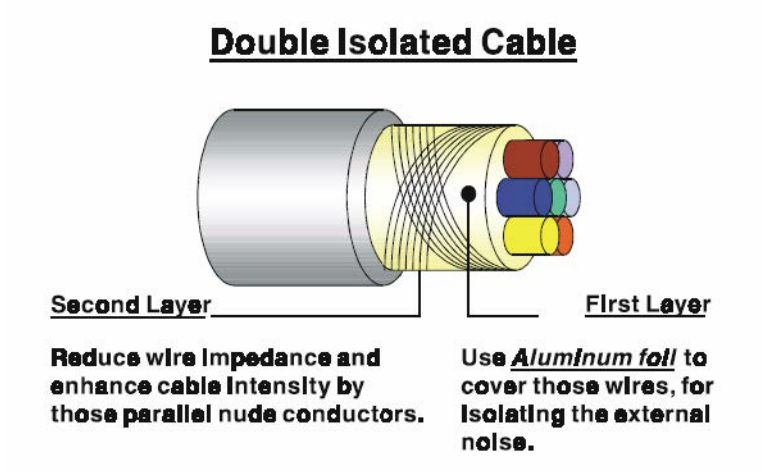


Figure B.10 Double Isolated Cable

Double isolated cable Figure 10 is an example of a double isolated cable. The first isolating layer of spiraled aluminum foil covers the conductors. The second isolation layer is several bare conductors that spiral and cross over the first shield layer. This spiraled structure makes an isolated layer for reducing external noise. Additionally, follow these tips just for your reference.

- The shield of a cable cannot be used for signal ground. The shield is designed for carrying noise, so the environment noise will couple and interfere with your system when you use the shield as signal ground.
- The higher the density of the shield - the better, especially for communication network.
- Use double isolated cable for communication network / AI / AO.
- Both sides of shields should be connected to their frame while inside the device. (for EMI consideration)
- Don’t strip off too long of plastic cover for soldering.

B.3.2 System Shielding

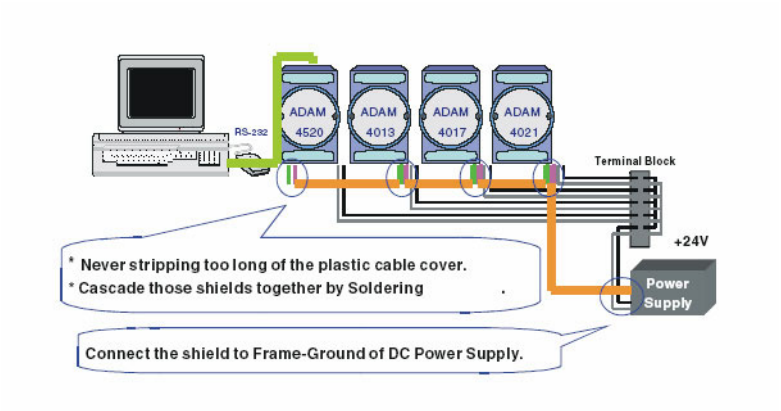


Figure B.11 System Shielding

- Never stripping too much of the plastic cable cover. This is improper and can destroy the characteristics of the Shielded-Twisted-Pair cable. Besides, the bare wire shield easily conducts the noise.
- Cascade these shields together by soldering. Please refer to follow- ing page for further detailed explanation.
- Connect the shield to Frame Ground of DC power supply to force the conducted noise to flow to the frame ground of the DC power supply. (The 'frame ground' of the DC power supply should be connected to the system ground)

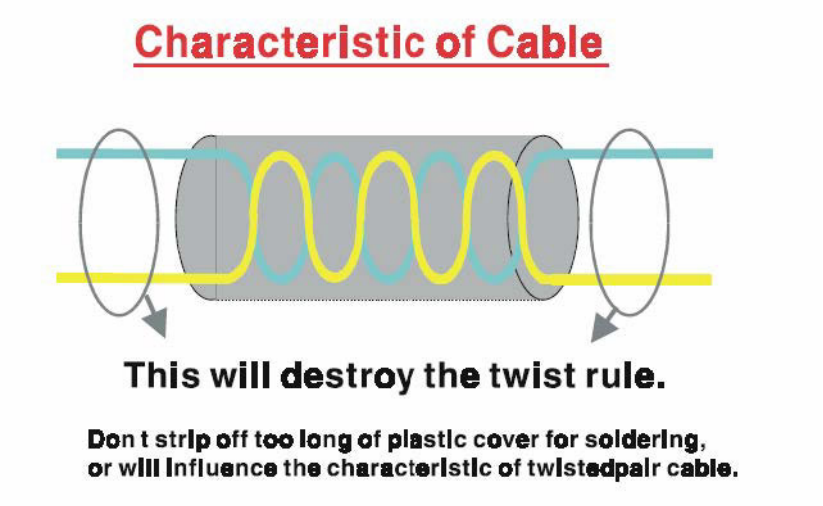


Figure B.12 Cable Characteristics

The characteristic of the cable Don't strip off too much insulation for soldering. This could change the effectiveness of the Shielded-Twisted-Pair cable and open a path to introduce unwanted noise.

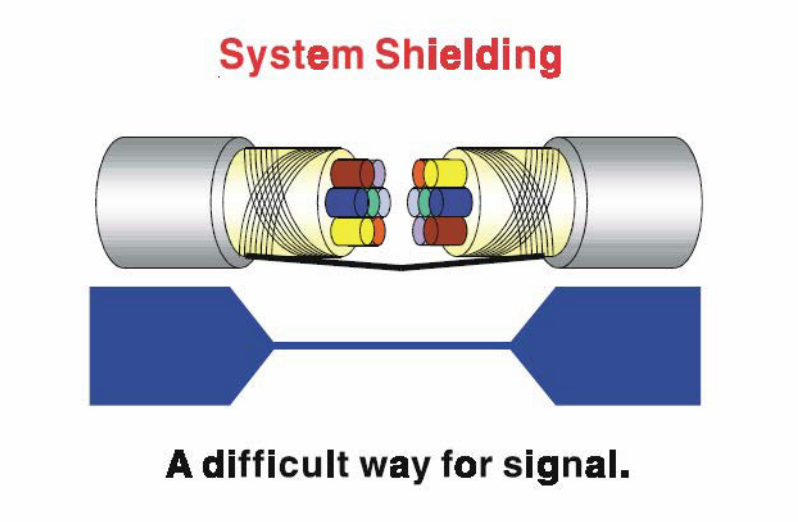


Figure B.13 System Shielding (1)

- Shield connection (1)
  If you break into a cable, you might get in a hurry to achieve your goal. As in all electronic circuits, a signal will use the path of least resis- tance. If we make a poor connection between these two cables we will make a poor path for the signal. The noise will try to find another path for easier flow.

Figure B.14 System Shielding (2)

- Shield Connection (2)
  The previous diagram shows you that the fill soldering just makes an easier way for the signal.

B.4 Noise Reduction Techniques

- Isolate noise sources in shielded enclosures.
- Place sensitive equipment in shielded enclosure and away from computer equipment.
- Use separate grounds between noise sources and signals.
- Keep ground/signal leads as short as possible.
- Use Twisted and Shielded signal leads.
- Ground shields on one end ONLY while the reference grounds are not the same.
- Check for stability in communication lines.
- Add another Grounding Bar if necessary.
- The diameter of power cable must be over 2.0 mm_2.
- Independent grounding is needed for A/I, A/O, and communication network while using a jumper box.
- Use noise reduction filters if necessary. (TVS, etc)
- You can also refer to FIPS 94 Standard. FIPS 94 recommends that the computer system should be placed closer to its power source to eliminate load-induced common mode noise.

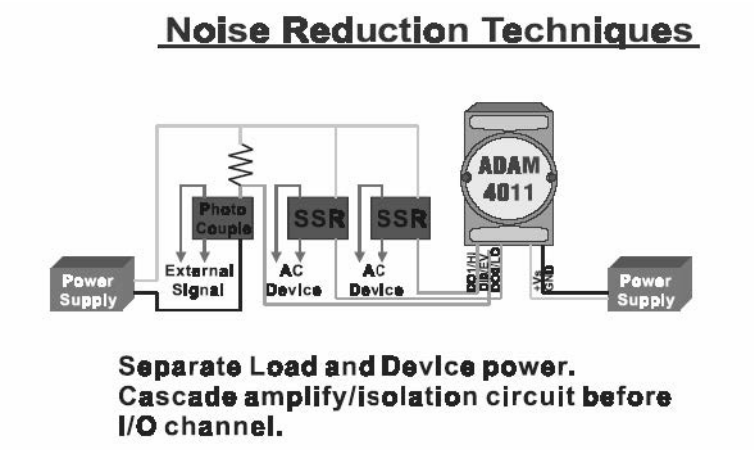


Figure B.15 Noise Reduction Techniques

B.5 Check Point List

- Follow the single point grounding rule?
- Normal mode and common mode voltage?
- Separate the DC and AC ground?
- Reject the noise factor?
- The shield is connected correctly?
- Wire size is correct?
- Soldered connections are good?
- The terminal screw are tight?

Chapter C

Reference Documents

Following resources are helpful for understanding how to use Multiprog Software and IEC-61131-3 programming languages.

C.1 Reference Documents

- Multiprog Quick Start Manual
- Multiprog User's Manual
- Mulitprog On-line Help
- ADAM-5550KW Series User's Manual
  (under Advantech Multiprog CD-ROM "Documentation" directory)
- ADAM-5000 I/O Module User"s Manual
  (under Advantech Multiprog CD-ROM "Documentation" directory)

C.2 Topics for Getting Familiar with Multiprog

- User Interfaces
- Basic Project Handling
- Text Editor, Graphical Editor and Edit Wizard
- Developing a Project
- Understanding the Architecture of Project
- POUs
- Instantiate
- Task
- IEC-61131-3 Programming Languages
- Function Blocks and Functions
- PLC Help

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